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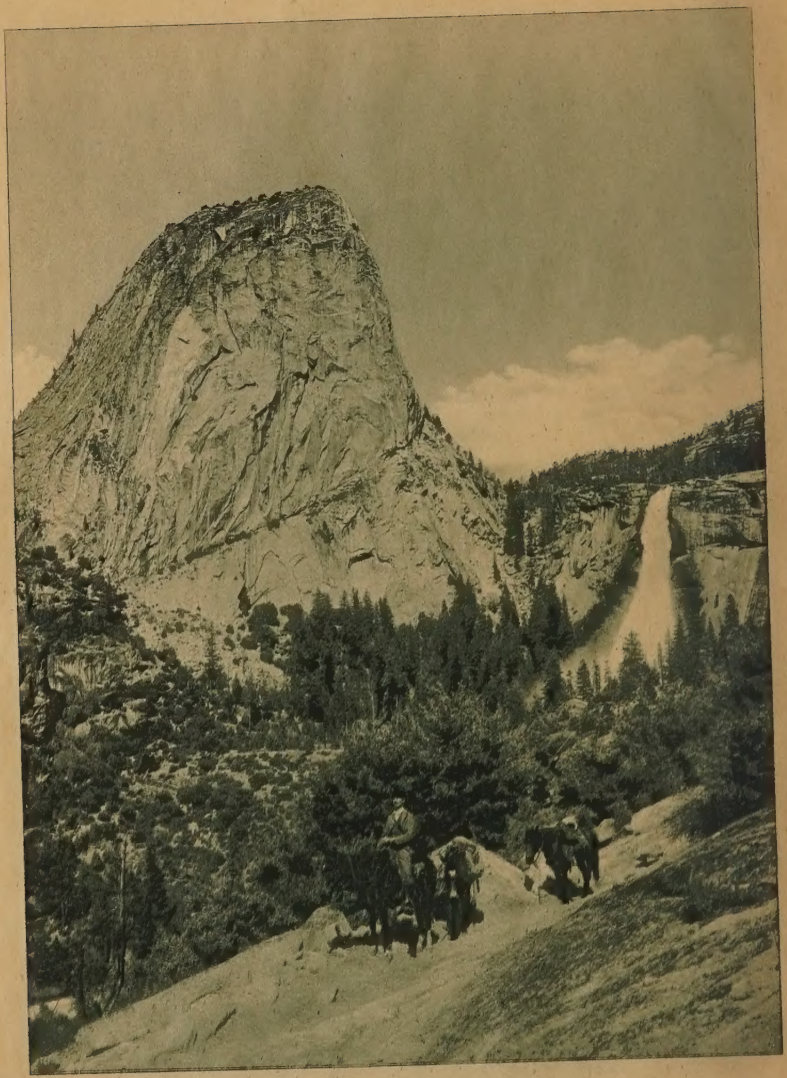

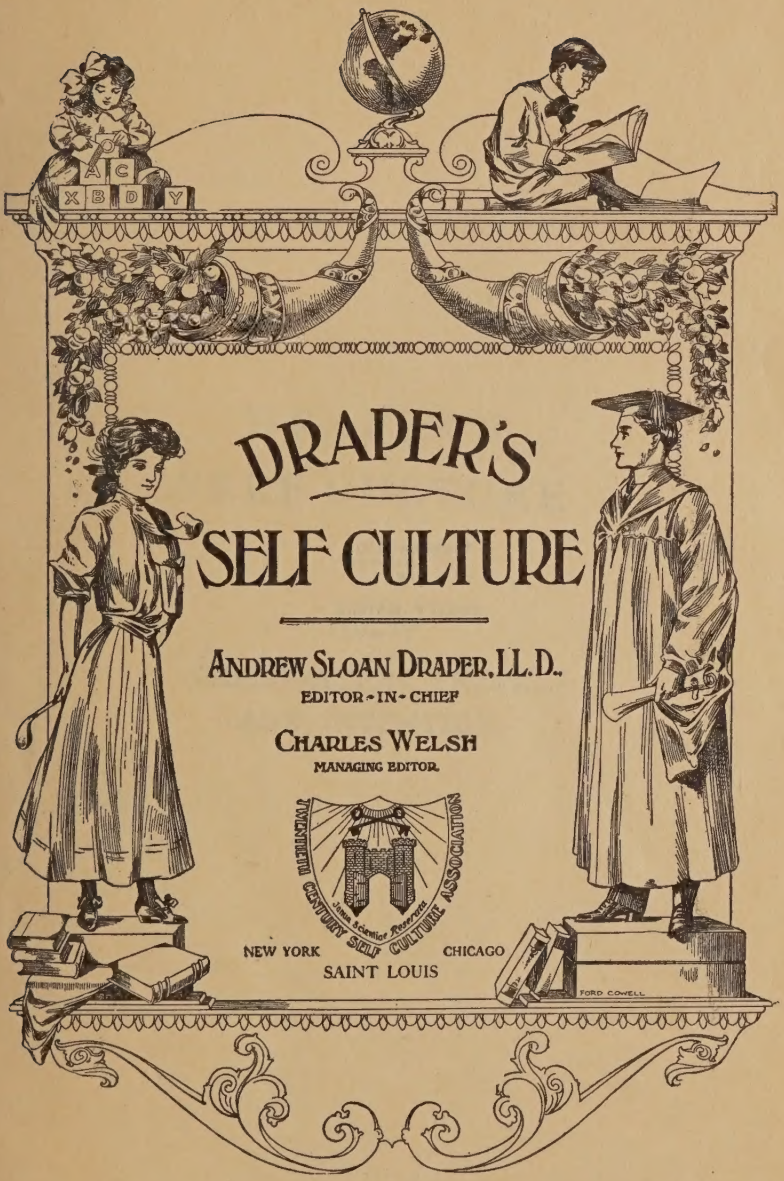
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DRAPER'S
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TWENTIETH CENTURY SELF CULTURE ASSOCIATION
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# DRAPER'S SELF CULTURE

VOL. IV

EXPLORATION, TRAVEL AND INVENTION.

# DRAPER'S SELF-CULTURE

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MANAGING EDITOR

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# INTRODUCTION TO VOL. IV.

BY

FREDERICK WILLIAM HAMILTON,

PRESIDENT OF TUFTS COLLEGE, MASS.

[The Rev. Frederick W. Hamilton, D. D., LL. D., was born at Portland, Me., March 30, 1860, fitted for college in the Portland High School; entered Tufts, whence he was graduated in 1880. After some experience in commercial life, in 1889 he returned to Tufts to take a special course in theology. He entered the Universalist ministry in 1890, and his first settlement was as pastor of the Universalist Church in Pawtucket, R. I., where he remained five years. In 1895 he accepted a call to the First Universalist Church of Roxbury. President of Tufts College since April 1, 1905. In 1899 Tufts conferred upon him the degree of D. D. St. Lawrence University conferred the degree of LL. D. upon him in 1906. He is the author of "The Church and Secular Life."]

Exploration, Travel, and Invention are three phases of man's unceasing search for the unknown. One of the most remarkable of human instincts, one of those also which most sharply differentiate man from the other animals, is this constant desire to penetrate the unknown, to solve the mysteries which lie all about us. Humanity has never learned to be quiescent in the face of mystery.

From the earliest times of human record and far anterior to any written history, man has always wondered what lay beyond the encircling forest, the mountain-ringed horizon, the uncompassing sea. The more daring, not content with wondering at the mystery, have adventurously striven to solve it. Often and again the wilderness of forest or of wave has swallowed them up, and no word has ever come back of their discoveries or of their sufferings. Now and again, however, success has crowned their efforts and they have returned to tell of the wonders they have seen, to bring back strange weapons and articles of use or adornment, and to point the way for others to follow.

No extremes of climate, no lack of materials for human sustenance, no dangers from savage beasts or still more savage men,

have served to daunt these bold spirits. No page of the world's history is more fascinating and instructive or more glorious with the record of heroism and high endeavor than that which tells the story of exploration. From the days when the Argonauts sailed in quest of the golden fleece through the time when Columbus and Magellan added a half to the world, to the days when Peary and Wellman are using all the resources of modern science and invention in the service of exploration, the search has gone on and it will never cease so long as there is a foot of the earth's surface which hides a secret not known to man.

What a wonderful record it is, this story of the gradual subjugation of the earth to human occupancy and use! Much of it is written, but much can never be written. Recent excavations in Crete show that in the prehistoric period of Greek civilization there were in use in the Mediterranean lands articles of amber which could have come only from the shores of the Baltic. What would we not give to have the records of the explorers who forced their way through the dense and inhospitable forests of those early days until they opened communication between the sunny South and the rugged North? Surely we would give much to know the experiences and the impressions of the Phœnicians who voyaged to South Africa and laid bare the riches of that wonderful land.

The blood stirs now at the thought of adventuring in strange waters and pathless lands, but we know well enough the general size and configuration of the earth, the dimensions of its continents and the location of its seas. Nothing but the insatiable instinct of discovery could have nerved men to enter a wilderness of whose ultimate limits they had no means of forming the slightest conception or to sail steadily forward for days and weeks over a trackless waste of apparently limitless seas, seas which so far as they in their general ignorance knew might well have no shore beyond them.

Many a stirring tale, however, is recorded for us. We may sail the unknown western seas with the fifteenth and sixteenth century navigators. We may search for spice islands and fountains of youth and inexhaustible mines with those who gave themselves to such quests. We may follow the labors and sufferings of those who sought the northwest passage and the pole. We may thread the African jungles with Livingston and Speke and Burton. We may accompany the pathfinders who opened the North American continent to civilization. We may share the adventures of those who have boldly torn aside the veil with which Japanese and Thibetan tried to exclude the outside world.

Many of the best of these accounts are reprinted in this volume,

and the sources are indicated where others may be found and where the whole story of exploration may be learned. The aim of the Editor has been not so much to attempt to cover the whole field as to indicate the extent, variety, and interest of it, to stimulate the desire for further knowledge of it, and to indicate with some fullness the sources where such knowledge may be obtained.

The associated subjects dealt with in this volume are included by logical relation. It is difficult to draw a line between exploration and what is more commonly recognized as travel. Even in these days of the Atlantic ferry, every traveller feels himself to be, at least as far as he is personally concerned, an explorer. Next to the delight of piercing the unknown is that of seeing the unfamiliar. The ways, speech, dress, architecture, in a word the whole life of the people of other lands, possesses great fascination for all men. So infinite are the variations thus to be noted in natural life and characteristics that books of travel never lose their interest. This is not only true of travel in the less known regions of the world but it is almost or quite equally true of travel in those parts of the world which would seem to be most familiar.

The reading of such books is not only a source of great pleasure but is a most important element in education as well. Without disparaging any of the more technical aspects of education, it remains true that the proper study of mankind is man. No man is widely or even well educated who has not some knowledge, the more extended the better, of the life of these men in other lands. Travel, admittedly the best of educations, is beyond the reach of most persons. Books of travel, those books which, with the aid of imagination, familiarize us with other life and make us truly citizens of the world, are within the reach of all. Such work as the Editor has done, setting these books in their true relation to progress and stimulating larger interest in them, is of the very highest educational value.

It was a happy thought to include invention with exploration and travel. It is another striking phrase of the same age-long search for the unknown. The same spirit which could not rest content without knowing what was behind the blue-black bulk of the mountain range, or beyond the shimmering plain of the sea, was equally restless until it had learned the character, meaning, and use of the forces of nature. The great inventors are great explorers, only in another of the world's houses of mystery. The workers in scientific fields, enriching mankind with the fruits of their discoveries, are travellers in unknown realms bringing back the results of their observations and opening the way for others. The Morses and Bells, the

Roentgens and Marconis, are the Columbuses and Cabots, the Magellans and Livingstons of science.

It is a mistake to suppose that the great discoveries in exploration and invention have been motived by mercenary considerations alone. No doubt such considerations have played a part in these things, especially in providing the funds to equip the expeditions and to conduct the researches. But it may be confidently claimed that all the important basic discoveries in both lines of endeavor would have been made had there been no pecuniary gain in prospect. Curiosity is a primary human instinct. Avarice is a secondary human characteristic. The centuries-long search for the pole has not been a search for wealth, and Benjamin Franklin, that most commonsensible of Poor Richards, did not fly his immortal kite for profit. The spirit of adventure has often been allied with the thirst for gold, but has ever been the stronger passion of the two. These things are worth remembering in a time like ours, when mercenary considerations count for so much and mercenary motives are so often said to rule mankind.

Science like exploration has had its heroes and its martyrs. Its annals too are glorious with the records of lofty endeavor and high courage and noble self-sacrifice. The search for the pole is equaled in fascinating interest by the search for the ultimate constitution of matter, and both so far have proved equally baffling. The discovery of electricity as an agent available for human needs was as remarkable as the circumnavigation of the world, and the discovery of radium and radio-activity as romantic as the discovery of Australia.

The volume before us deals in a most stimulating way with the wonders and the romances of scientific discovery. A reading of it cannot fail to stimulate an intelligent interest in those familiar, yet mysterious, marvels of modern science. It has certainly been a valuable service to the reading public, especially the younger portion whose interests are yet to be determined and tastes to be formed, to place within convenient compass so much that is stimulating and at the same time to indicate so clearly the lines of future reading. It is a real service to the course of education.

FREDERICK WILLIAM HAMILTON,
PRESIDENT TUFTS COLLEGE.

# EXPLORATION, TRAVEL AND INVENTION.

## THE PROGRESS OF DISCOVERY

### From the Earliest Times Down to the Present.

*[This table will not only be useful for reference, but will guide the student who wishes to study any particular field, or any particular period of exploration. Not one of them could be entirely covered in this book but they are all represented here, and with the aid of the list of one hundred of the best books at the end of the volume the reader should have no difficulty in following any line he wishes.]*

| Date. | Explorer and Nationality. | Discovery or Exploration. |
|---|---|---|
| B.C. | | |
| 1400–1250 | Egyptians | Invasions of Habesh, Arabia, Phœnicia, Syria. |
| ? 1350 | Greeks | Argonautic expedition to Colchis. |
| 1000 | Phœnicians | Voyages to Ophir, Gades, Britain. |
| 750 | Greeks | Extension of Colonies in the Mediterranean and Pontus Euxinus. |
| 700 | Samians | Spain (Tartessus) discovered for the Greeks. |
| 600 | Phœnicians | Circumnavigation of Africa by order of Necho. |
| 500 | Himilco (Carthag.) | Atlantic coasts of Europe. Sargasso Sea. Said to have visited Britain. |
| " | Anaximander (of Miletus) | Makes the first maps. |
| " | Hecatæus (of Miletus) | Writes the first geography |
| 470 | Hanno (Carthag.) | West Africa as far as Cape Palmas. |
| 330 | Pytheas of Massilia | ? Thule, North Sea, Scandinavia. |
| " | Nearchus (Macedon.) | Sails from the Indus to Red Sea. |
| 329–325 | Alexander the Great | Expedition to Iran, Turan and India. |
| 290 | Egyptians | Navigate the East Coast of Africa. |
| 218 | Romans | Hannibal crosses the Alps. |
| about 120 | Eudoxus of Cyzicus | Attempts circumnavigation of Africa. |
| 61–58 | Romans | Julius Cæsar in Gaul, Germany, and Britain. |
| since 30 | Romans | Extension of geographical knowledge and commerce as far as Central Asia. |
| 20 | Strabo (Greek) | Describes Roman Empire and first mentions Thule and Ireland. |
| 15 | Romans | Tiberius discovers the Lake of Constance; Drusus, the Brenner Pass. |
| A.D. | | |
| 84 | Romans | Agricola circumnavigates Britain. |
| 150 | Claudius Ptolemy (Egypt.) | Constructs his Geography and Atlas. |
| 518–21 | Hoei-sing (Chinese) | Visits Pamirs and Punjab. |
| 671–95 | I-tsing (Chinese) | Visits Java, Sumatra, and India. |
| 861 | Norsemen | Faroe Islands. North Cape of Europe rounded. |
| 865 | Naddod (Norse) | Discovers Iceland. Visited by Irish monks about 795. |
| 876 | Gunnbjorn (Norse) | Greenland coast. Rediscovered by Erik the Red (983). |
| 985 | Erik the Red (Norse) | Colonizes Greenland. |
| ? 1000 | Lyef (Lief) Erickson (son of Erik the Red) | Discovers New Foundland (Helluland), Nova Scotia (Markland), and coast of New England (Vinland) [?]. |
| 1154 | Edrisi (Sicily) | Geographer to King of Sicily, produces his geography. |
| about 1200 | Arabs | Trading merchants discover Siberia. |
| 1253 | Ruysbroek | Reaches Karakorum, the ancient seat of the Mongol Empire. |

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| Date. | Explorer and Nationality. | Discovery or Exploration. |
|---|---|---|
| A.D. | | |
| 1271–95 | Marco Polo (Venet.) | Travels in Central Asia, China, India, Persia. |
| 1290 | Genoese | Canaries, Azores, etc. |
| 1325–52 | Ibn Batuta (Arab.) | Travels through the whole Mohammedan World, N. Africa, E. Africa, S. Russia, Arabia, India and China. |
| 1327 | Sir John Mandeville (Eng.) | ? Travels in India. |
| 1415–60 | Prince Henry (Port.) | Gives an impetus to Portuguese voyages of discovery. |
| 1419–20 | J. Gonzales and Martin Vaz (Port.) | Porto Santo and Madeira discovered. |
| 1442 | Nuno Tristao (Port.) | Cape Verde, etc. |
| ? 1460 | Cintra and Costa (Port.) | Coast of Guinea reached. |
| 1474 | Toscanelli (Ital.) | Sends Columbus his map showing the western route to Cathay (China). |
| 1485 | Diego Cam (Port.) | Mouth of the Congo reached. |
| 1487 | Bartholomew Diaz (Port.) | Rounds Cape of Good Hope. |
| 1492–98 | Columbus (Gen.) | America, West Indies, Trinidad, Cuba, etc. |
| 1497–98 | Giovanni Cabot (Anglo-Ven.) | Sails along E. Coast of America from Labrador as far as Florida. |
| 1498 | Vasco da Gama (Port.) | Route to India by Cape of Good Hope. |
| 1499 | Amerigo Vespucci (Ital.) | Venezuela, and that America was not "part of Asia." |
| 1499 | Pinzon (Span.) | Discovers mouth of R. Amazon and Cape St. Roque. |
| 1500 | G. Cortereal (Port.) | Reaches entrance of Hudson Strait, called by him Strait of Anian. |
| " | Alvarez Cabral (Port.) | Brazil (named by him Ilha da Vera Cruz, being S. part of Bahia State). |
| 1502 | Columbus (Gen.) | Central America on his fourth voyage. |
| 1506 | Denys (French) | Explored Gulf of St. Lawrence. |
| 1512 | Ponce de Leon (Span.) | Florida. |
| 1513 | Portuguese | Reach the Moluccas. |
| 1513 | Balboa (Span.) | Crosses Isthmus of Panama and discovers Pacific Ocean. |
| 1516 | Solis (Span.) | Reaches La Plata. |
| 1517 | Sebastian Cabot (Eng.) | Hudson Strait. |
| 1517 | Cordova (Span.) | Explored Yucatan. |
| 1518 | Grijalva (Span.) | Mexico. |
| 1520 | De Ayllon (Span.) | Carolina. |
| 1519–21 | Cortez (Span.) | Conquest of Mexico. |
| 1519–21 | Magellan (Span.) | First to circumnavigate the globe. Passes through the Strait of Magellan, crosses the Pacific, and discovers the Philippines. |
| 1524 | Verrazani (French) | U. S. north of Cape Fear. |
| 1528 | Narvaez (Span.) | Explored Florida. |
| 1534 | Pizzaro (Span.) | Completes the Conquest of Peru. |
| 1535 | Diego d'Almagro (Span.) | Conquers Chili. |
| 1535–42 | Jacques Cartier (Fr.) | Gulf of St. Lawrence. Ascends river to Hochelaga (Montreal). |
| 1539 | Francesco de Ulloa (Span.) | Explores Gulf of California. |
| 1539–42 | De Soto (Span.) | Southern U. S. and discovered the Mississippi River. |
| about 1540 | French | Continent of Australia seen by French sailors. |
| 1540 | Coronado (Span.) | New Mexico and Arizona. |
| 1541 | Pizarro and Orellana (Span.) | Amazon River. |
| 1542 | Antonio de Mota | First reaches Japan. |
| " | Ruy Lopez de Villalobos (Span.) | Discovers Pelew Island, and takes possession of Philippine Islands for Spain. |
| " | Pinto (Port.) | Visits Japan. |
| " | Cabrillo (Span.) | Pacific Coast of U. S. |
| 1553 | Sir H Willoughby (Eng.) | Novaia Zembla. |
| 1576 | Frobisher (Eng.) | Labrador and Baffin Land. |
| 1577–80 | Sir F. Drake (Eng.) | Second circumnavigation of the globe, and first saw Cape Horn. Explored W. coast of N. America nearly as far as Vancouver Archipelago. |
| 1584 | Amidas and Barlow (Eng.) | Explored Albemarle Sound and Roanoke I. |
| 1587 | J. Davis (Eng.) | Davis Strait. |
| 1596 | Barentz and Heemskerk (Dut.) | Spitzbergen, Bear Island, etc. |
| 1598 | Mendaña (Span.) | Discovers Marquesas Islands. |
| 1602 | Gosnold (Eng.) | Discovered coast of Massachusetts. Shortened route across Atlantic. |
| 1606 | Quiros (Span.) | Tahita (Sagittaria), and other South Sea Islands. |
| " | Torres (Span.) | Torres Strait. Dutch reach Australia. |

| Date. | Explorer and Nationality. | Discovery or Exploration. |
|---|---|---|
| A.D. | | |
| 1608 | Champlain (French)..... | Discovers Lake Ontario. |
| 1609 | Henry Hudson (Eng.)..... | Explores Hudson River, N. America. |
| 1610 | Henry Hudson (Eng.)..... | Discovers Hudson's Bay. |
| 1614–17 | Spillbergen (Dut.)..... | Circumnaviga ion of the globe. |
| 1616 | W. Baffin (Eng.)..... | Enters Baffin Bay. |
| " | LeMaire and Schouten (Dut.) | Round Cape Horn. |
| " | Dirk Hartog (Dut.)..... | West coast of Australia. |
| 1618 | G. Thompson (Eng. mer.). | Sails up Gambia. |
| 1642 | Abel Tasman (Dut.)..... | Van Diemen's Land (Tasmania) and New Zealand. |
| 1643 | Vries (Dut.)..... | Explores E. coast Japan, Saghalien, and Kurile Is. |
| 1645 | Deshnev (Cossack)..... | Rounds East Cape of Asia. |
| 1660 | French..... | Lake region of the St. Lawrence discovered. |
| 1673 | Marquette and Joliet (Fr.). | Exploration of the Mississippi from the north. |
| 1682 | La Salle (French)..... | Sailed to mouth of Mississippi River. |
| 1725–43 | Russians..... | Exploration of the coasts of Siberia. |
| 1728 and 41 | Bering (Dan.) and Tishirikov (Rus.)..... | Bering Strait and the NW. coast of America. |
| 1740–44 | Anson (Eng.).. ..... | Circumnavigates the globe. |
| 1768–79 | Capt. Cook (Eng.)..... | Voyages round the world. Hydrographical surveys of the Society Islands, Sandwich Islands, E. coast of Australia, Cook Strait in New Zealand, Antarctic Ocean, NW. coast of America, etc. |
| 1770 | James Bruce (Scot.)..... | Source: of the Blue Nile. |
| " | Liakhov (Russian)..... | Discovers New Siberian Islands. |
| 1776–9 | Bougainville, L. A. de (French)..... | First French circumnavigator. |
| 1785–88 | La Perouse (French)..... | North of Japan, Saghalien, etc. |
| 1789 | A. Mackenzie (Scot.)..... | Exploration of the Mackenzie River. |
| 1792 | Vancouver (Eng.)..... | Vancouver Island circumnavigated. Discovered by Perez, 1774. Exploration of NW. coast of America. |
| 1795–1806 | Mungo Park (Scot.)..... | Journeys and explorations in the Niger districts. |
| 1799–1804 | Alex. von Humboldt (Ger.). | Explorations in South America and "Cosmos." |
| 1801–1804 | Flinders (Eng.). ..... | Southern coasts of Australia. |
| 1803–6 | Lewis & Clarke (Am.). ..... | Expedition to the Pacific. |
| 1805–9 | Salt (Eng.)..... | Visit to Abyssinia. |
| 1807–8 | Klaproth (Ger.)..... | Exploration of the Caucasus. |
| 1819 | Sir E. Parry (Eng.)..... | Parry Archipelago. |
| " | Sir J. Franklin..... | |
| 1825 | Richardson and Back (Eng.)..... | Coppermine and Mackenzie Rivers explored. |
| 1819 | Long (U. S.) ..... | Exploration of Rocky Mountains. |
| 1819 | Wm. Smith (Eng.)..... | South Orkney Islands and South Shetlands. Visited by Weddell in 1822. |
| 1823 | Wrangel (Rus.)..... | Discovers Wrangel Land. |
| 1823 | Denham and Clapperton (Eng.) ..... | Lake Chad. |
| 1825–26 | A. G. Laing (Scot.)..... | Reached Timbuktu from Tripoli. |
| 1827–8 | René Caillie (French)..... | Journey from Kakandy to Timbuktu and Morocco. |
| 1829 | Sturt (Eng.)..... | Descends the Murrumbidgee and discovers the Murray River. |
| 1830–32 | Biscoe (Eng.)..... | Enderby Land and Graham Land. |
| 1830 | ..... ..... | Royal Geographical Society founded in London. |
| 1831 | Sir J. C. Ross (Eng.)..... | Magnetic North Pole. |
| 1832 | Laird and Oldfield (Scot.).. | Exploration of the Niger and Benué. |
| 1833–35 | Sir G. Back (Eng.)..... | Great Fish River. |
| 1835 | Sir F. Schomburgk (Ger.).. | Explorations in Guiana. |
| 1837 | Wood (Eng.) ..... | Sources of the Oxus. |
| 1837–40 | D'Urville (French)..... | Adélie Land. Reached 66° 30′ S. lat. |
| 1839 | J. Balleny (Eng.)..... | Balleny Islands, 66° 44′ S. lat. |
| 1839 | Eyre (Eng.)..... | Discovers Lake Torrens, S. Australia, and in 1841 journeys from Adelaide to King George's Sound. |
| 1840 | Trümmer..... | Remains of ancient Nineveh. |
| 1841 | Sir James C. Ross (Eng.)... | Victoria Land, with volcanoes Erebus and Terror. |
| 1841–73 | D. Livingstone (Scot.)..... | Thirty years' travel in Central South Africa. |
| 1844–45 | Leichhardt (Ger.)..... | Crosses Australia, Moreton Bay to Port Essington. |
| 1845 | Sir John Franklin (Eng.).. | Sails on his last voyage never to return. |
| 1848 | Rebmann and Krapf (Ger.). | Mt. Kilima Njaro. Sighted Mt. Kenia. |
| 1849–55 | Richardson and Barth (Eng.-Ger.)..... | Western Sudan and Sahara. |
| 1850 | Sir R. M'Clure (Irish)..... | Northwest Passage. |
| 1852–4, 1861 | Sir C. R. Markham (Eng.).. | Exploration in Peru. |
| 1856–59 | Du Chaillu (French)..... | Basin of Ogowé River, W. Africa. |

| Date. | Explorer and Nationality. | Discovery or Exploration. |
|---|---|---|
| A.D. | | |
| 1858 | Sir R. Burton (Scot.) | Lake Tanganyika. |
| " | Speke and Grant (Brit.) | Victoria Nyanza. |
| 1860 | Sir S. Baker (Eng.) | Explores Upper Nile. Discovers Albert Nyanza, 1864. |
| 1862 | M'Donall Stuart (Scot.) | Crossed Australia. |
| 1862-63 | W. G. Palgrave (Eng.) | Journeys in Central and Eastern Arabia. |
| 1864-66 | G. Rohlfs (Ger.) | Journey in W. Sudan by Ghadames, Murzuk, and Wadai to R. Niger. |
| 1867-72 | Richthofen (Ger.) | Extensive travel and exploration in China. |
| 1868-71 | G. Schweinfurth (Ger.) | Exploration of the Jur, Niam-Niam, and Monbuttu countries. |
| 1869 | G. Nachtigal (Ger.) | Explorations in Lake Chad region and Central Sudan States. |
| 1870-1886 | Prejevalsky (Rus.) | Journeys in Mongolia, Tibet, etc. |
| 1871-75 | Leigh Smith (Eng.) | Exploration of N. part of Spitzbergen. Vaigats Is |
| 1872 | Payer and Weyprecht (Austrian) | Franz Joseph Land. |
| 1872-76 | "Challenger" Expedition (Brit.) | Explores the depths of the oceans. |
| 1872-76 | Ernest Giles | Traverses Northwest Australia. |
| 1873 | Warburton, E. (Irish) | Crosses Western Australia from East to West. |
| 1874-75 | Lieut. Cameron (Eng.) | Crosses Equatorial Africa. |
| 1876 | De Breeze (French) | Explorations in the Ogowé and Gabun region. |
| 1876-90 | H. M. Stanley (Eng.) | Congo Basin; Mt. Ruwenzori; Forests on the Aruwimi, etc. |
| 1876 | Sir George Nares and A. H. Markham (Eng.) | Grant Land. Penetrated as far N. as 83° 20′ lat. |
| 1878-79 | Nordenskjöld (Swed.) | Northeast passage. |
| 1878-89 | Thomson (Scot.) | Journeys through Masai Land, British South Africa, Sokoto, Morocco, etc. |
| 1878-85 | Major Serpa Pinto (Port.) | Twice crosses Africa. |
| 1878-92 | Emin Pasha (Ger.) | Travels and Surveys in Equatorial Africa. Discovery of Semliki River, etc. |
| 1879 | Moustier and Zweifel (Swiss.) | Sources of the Niger. |
| 1881-85 | General Greely (U. S.) | Grinnell Land and NE. coast of Greenland. |
| 1885 | Wiesmann (Ger.) | Across Africa from West coast, Congo Basin. |
| " | Junker (Rus.-Ger.) | Welle-Mobangi, etc. |
| 1886 | Peary, R. E. (U. S.) | North Greenland. |
| 1887 | Capt. Younghusband (Eng.) | Travels from Pekin to Kashmir. |
| 1893-96 | Nansen (Norw.) | Hviotenland, etc.; reaches his "Farthest North" in lat. 86° 1° 6″ N. |
| 1897 | Jackson (Scot.) | Surveys and explorations in Franz Josef Land. |
| 1893-97 | Sven Hedin (Swed.) | Explorations in North Central Asia. |
| 1895-96 | Pr. Henri d'Orléans | Travels in Tonkin and China. |
| 1896 | Donaldson Smith (Scot.) | Explores region of Lak Rudolf. |
| 1896-98 | Capt. Marchand (Fr.) | Travels from Upper Mobangi to Fashoda. |
| 1897 | Andrée (Swed.) | Attempt to cross over the North Pole in a balloon with fatal results. |
| 1897 | D. Carnegie (Scot.) | Crosses Western Australia from S. to N. |
| 1898-99 | De Gerlache (Belgian) | "Belgica," first ship to winter within Antarctic circle. |
| 1899 | Major Gibbons | Explorations in Congo and Zambezi headwaters. |
| 1900 | Borchgrevink (Brit. Ex.) | Reached lat. 78° 50′ S. via Victoria Land. |
| " | Duke of Abruzzi (Ital.) | Reached lat. 86° 33′ N. via Franz Josef Land. |
| 1900-02 | Sven Hedin (Swed.) | Important Journey in Central Asia. |
| 1903 | Sir John Evans (Eng.) | Archeological discoveries in Crete. |
| 1905 | Theodore M. Davis | Important discoveries in Egypt. |

# LEIF, THE LUCKY, AND THE WINELAND VOYAGES.

BY

HAUK ERLENDSSON.

Translated by A. M. REEVES.

According to the Ancient Sagas Leif Ericson sailed from Greenland about 1000 A. D. with 35 men in search of a land seen 20 years before by one Herjulfson. He discovered what is supposed to be the coast of New England which he named Vin or Vine-land because of the grape-vines he found there. An ideal statue of him by Anne Whitney is erected in Boston, Mass.

ERIC was married to a woman named Thorhild and had two sons: one of these was named Thorstein, and the other Leif. They were both promising men. Thorstein lived at home with his father, and there was not at that time a man in Greenland who was accounted of so great promise as he. Leif had sailed to Norway, where he was at the court of King Olaf Tryggvason.

He was well received by the king, who felt that he could see that Leif was a man of great accomplishments. Upon one occasion the king came to speech with Leif, and asked him, "Is it thy purpose to sail to Greenland in the summer?" "It is my purpose," said Leif, "if it be your will." "I believe it will be well," answers the king, "and thither thou shalt go upon my errand, to proclaim Christianity there." Leif replied that the king should decide, but gave it as his belief that it would be difficult to carry this mission to a successful issue to Greenland.

The king replied that he knew of no man who would be better fitted for this undertaking, "and in thy hands the cause will surely prosper." "This can only be," said Leif, "if I enjoy the grace of your protection." Leif put to sea when his ship was ready for the voyage. For a long time he was tossed about upon the ocean, and

came upon lands of which he had previously had no knowledge. There were self-sown wheat fields and vines growing there. There were also those trees there which are called "mausur," and of all these they took specimens. Some of the timbers were so large that they were used in building. Leif found men upon a wreck, and took them home with him, and procured quarters for them all during the winter. In this wise he showed his nobleness and goodness, since he introduced Christianity into the country, and saved the men from the wreck; and he was called Leif, the Lucky, ever after. Leif landed in Ericsfirth, and then went home to Brattahlid; he was well received by every one. He soon proclaimed Christianity throughout the land, and the Catholic faith, and announced King Olaf Tryggvason's messages to the people, telling them how much excellence and how great glory accompanied this faith. . . .

About this time there began to be much talk at Brattahlid, to the effect that Wineland the Good should be explored, for, it was said, that country must be possessed of many goodly qualities. And so it came to pass that Karlsefni and Snorri fitted out their ship, for the purpose of going in search of that country in the spring. Biarni and Thorhall joined the expedition with their ship and the men who had borne them company. . . .

Thorhall was stout and swarthy, and of giant stature; he was a man of few words, though given to abusive language, when he did speak, and he ever incited Eric to evil. He was a poor Christian; he had a wide knowledge of the unsettled regions. He was on the same ship with Thorvard and Thorvald. They had that ship which Thorbiorn had brought out. They had in all one hundred and sixty men, when they sailed to the Western settlement, and thence to Bear Island. Thence they bore away to the southward. Then they saw land, and launched a boat, and explored the land, and found there large flat stones (Hellur), and many of these were twelve ells wide; there were many Arctic foxes there. They gave a name to the country, and called it Helluland (the land of flat stones).

Then they sailed with northerly winds, and land then lay before them, and upon it was a great wood and many wild beasts; an island lay off the land to the southeast, and there they found a bear, and they called this Biarney (Bear Island), while the land where the wood was they called Markland (Forest-land).

Thence they sailed southward along the land for a long time, and came to a cape; the land lay upon the starboard; there were long strands and sandy banks there. They rowed to the land and found upon the cape there the keel of a ship, and they called it the Kialarnes (Keelness); they also called the strands Furdustrandir (Wonder-strands), because they were so long to sail by. Then the country became indented with bays, and they steered their ships into a bay. . . . Now when they had sailed past Wonder-strands, they put the Gaels ashore, and directed them to run to the southward, and investigate the nature of the country, and return again before the end of the third half-day. They were each clad in a garment, which they called "kiafal," and which was so fashioned, that it had a hood at the top, was open at the sides, was sleeveless and was fastened . . . with buttons and loops, while elsewhere they were naked. Karlsefni and his companions cast anchor, and lay there during their absence; and when they came again, one of them carried a bunch of grapes, and the other an ear of new-sown wheat. They went on board the ship, whereupon Karlsefni and his followers held on their way, until they came to where the coast was indented with bays.

They stood into a bay with their ships. There was an island out at the mouth of the bay, about which there were strong currents, wherefore they called it Straumey (Stream Isle). There were so many birds there, that it was scarcely possible to step between the eggs. They sailed through the firth, and called it Straumfiord (Streamfirth), and carried their cargoes ashore from the ships, and established themselves there. They occupied themselves exclusively with the exploration of the country. They remained there during the winter, and

they had taken no thought for this during the summer. The fishing began to fail, and they began to fall short of food. . . . The weather then improved, and they could now row out to fish, and thenceforward they had no lack of provisions, for they could hunt game on the land, gather eggs on the island, and catch fish from the sea. . . .

It is said that Thorhall wished to sail northward beyond Wonder-strands, in search of Wineland, while Karlsefni desired to proceed southward, off the coast. . . .

It is now to be told of Karlsefni, that he cruised southward off the coast, with Snorri and Biarni, and their people. They sailed for a long time, until they came at last to a river, which flowed down from the land into a lake, and so into the sea. There were great bars at the mouth of the river, so that it could only be entered at the height of flood-tide. Karlsefni and his men sailed into the mouth of the river, and called it there Hóp (a small land-locked bay). They found self-sown wheat-fields on the land there, wherever there were hollows, and wherever there was hilly ground, there were vines. Every brook there was full of fish. They dug pits on the shore where the tide rose highest, and when the tide fell, there were halibuts in the pits. There were great numbers of wild animals of all kinds in the woods. They remained there half a month, and enjoyed themselves, and kept no watch. They had their livestock with them. Now one morning early, when they looked about them, they saw a great number of skin-canoes, and staves were brandished from the boats, with a noise like flails, and they were revolved in the same direction in which the sun moves. Then said Karlsefni, "What may this betoken?" Snorri, Thorbrand's son, answers him: "It may be, that this is a signal of peace, wherefore let us take a white shield and display it." And thus they did. Thereupon, the strangers rowed toward them, and went upon the land, marvelling at those whom they saw before them. They were swarthy men, and ill looking, and the hair of their heads was ugly. They had great eyes, and were broad of cheek. They tarried there for a long time looking

curiously at the people they saw before them, and then rowed away, and to the southward around the point.

Karlsefni and his followers had built their huts above the lake; some of their dwellings being near the lake, and others farther away. Now they remained there that winter. No snow came there, and all of their live-stock lived by grazing. And when spring opened, they discovered early one morning, a great number of skin-canoes, rowing from the south past the cape, so numerous, that it looked as if coals had been scattered broadcast out before the bay; and on every boat staves were waved. Thereupon Karlsefni and his people displayed their shields, and when they came together, they began to barter with each other. Especially did the strangers wish to buy red cloth, for which they offered in exchange peltries, and quite gray skins. They also desired to buy swords and spears, but Karlsefni and Snorri forbade this. In exchange for perfect unsullied skins, the Skrellings would take red stuff, a span in length, which they would bind around their heads. So their trade went on for a time, until Karlsefni and his people began to grow short of cloth, when they divided it into such narrow pieces, that it was not more than a finger's breadth wide, but the Skrellings still continued to give just as much for this as before, or more.

It so happened, that a bull, which belonged to Karlsefni and his people, ran out from the woods, bellowing loudly. This so terrified the Skrellings, that they sped out to their canoes, and then rowed away to the southward along the coast. For three entire weeks nothing more was seen of them. At the end of this time, however, a great multitude of Skrelling boats was discovered approaching from the south, as if a stream were pouring down, and all of their staves were waved in the direction contrary to the course of the sun, and the Skrellings were all uttering loud cries. Thereupon Karlsefni and his men took red shields and displayed them. The Skrellings sprang from their boats, and they met them, and fought together. There was a fierce shower of missiles, for the Skrellings had

war-slings. Karlsefni and Snorri observed that the Skrellings raised upon a pole a great ball-shaped body, almost the size of a sheep's belly, and nearly black in color, and this they hurled from the pole up on the land above Karlsefni's followers, and it made a frightful noise, where it fell. Whereupon a great fear seized upon Karlsefni and all his men, so that they could think of naught but flight, and of making their escape up along the river bank, for it seemed to them, that the troop of the Skrellings was rushing toward them from every side, and they did not pause until they came to certain jutting crags, where they offered a stout resistance. Freydis came out, and seeing that Karlsefni and his men were fleeing, she cried: "Why do you flee from these wretches, such worthy men as ye, when meseems, ye might slaughter them like cattle. Had I but a weapon, methinks, I would fight better than any of you!" They gave no heed to her words. Freydis sought to join them, but lagged behind, for she was not hale; she followed them, however, into the forest, while the Skrellings pursued her; she found a dead man in front of her; this was Thorband, Snorri's son, his skull cleft by a flat stone; his naked sword lay beside him; she took it up and prepared to defend herself with it. The Skrellings then approached her, whereupon, she . . . slapped her breast with the naked sword. At this the Skrellings were terrified and ran down to their boats, and rowed away. Karlsefni and his companions, however, joined her and praised her valor. Two of Karlsefni's men had fallen, and a great number of Skrellings. Karlsefni's party had been overpowered by dint of superior numbers. They now returned to their dwellings and bound up their wounds, and weighed carefully what throng of men that could have been, which had seemed to descend upon them from the land; it now seemed to them that there could have been but the one party, that which came from the boats, and that the other troop must have been an ocular delusion. The Skrellings, moreover, found a dead man, and an axe lay beside him. One of their number picked up the axe and struck a

tree with it, and one after another (they tested it), and it seemed to them to be a treasure, and to cut well; then one of their number seized it, and hewed at a stone with it, so that the axe broke, whereat they concluded that it could be of no use, since it would not withstand stone, and they cast it away.

It now seemed clear to Karlsefni and his people, that although the country thereabouts was attractive, their life would be one of constant dread and turmoil by reason of the (hostility of the) inhabitants of the country, so they forthwith prepared to leave, and determined to return to their own country. They sailed to the northward off the coast, and found five Skrellings clad in skin-doublets, lying asleep near the sea. There were vessels beside them, containing animal marrow mixed with blood. Karlsefni and his company concluded that they must have been banished from their own land. They put them to death. They afterward found a cape, upon which there was a great number of animals . . . which lay there at night. They now arrive again at Streamfirth, where they found great abundance of all those things of which they stood in need. Some men say that Biarni and Freydis remained behind here with a hundred men, and went no further; while Karlsefni and Snorri proceeded to the southward with forty men, tarrying at Hop barely two months, and returning again the same summer. Karlsefni then set out with one ship in search of Thorhall, the Huntsman, but the greater part of the company remained behind. They sailed to the northward around Keelness, and then bore to the westward, having land to the larboard. The country there was a wooded wilderness as far as they could see, with scarcely an open space; and when they had journeyed a considerable distance, a river flowed down from the east toward the west.

# SOME EARLY SPANISH DISCOVERIES IN AMERICA.

BY

BRANTZ MAYER.

Brantz Mayer was born in Baltimore in 1809 and died in 1879. He was Secretary of the U. S. Legation in Mexico 1841–2, and later a colonel in the Federal Army in the Civil War. He published several works on Mexico and a novel entitled "Captain Carnot."

COLUMBUS, after coasting the shores of Cuba for a great distance, had always believed that it constituted a portion of the continent, but it was soon discovered that the illustrious admiral had been in error, and that Cuba, extensive as it appeared to be, was, in fact, only an island.

In February, 1517, a Spanish *hidalgo,* Hernandez de Cordova, set sail, with three vessels, toward the adjacent Bahamas in search of slaves. He was driven by a succession of severe storms on coasts which had hitherto been unknown to the Spanish adventurers, and finally landed on that part of the continent which forms the north-eastern end of the peninsula of Yucatan, and is known as Cape Catoché. Here he first discovered the evidence of a more liberal civilization than had been hitherto known among his adventurous countrymen in the New World. Large and solid buildings, formed of stone — cultivated fields — delicate fabrics of cotton and precious metals — indicated the presence of a race that had long emerged from the semi-barbarism of the Indian Isles. The bold but accidental explorer continued his voyage along the coast of the peninsula until he reached the site of Campeché; and then, after an absence of seven months and severe losses among his men, returned to Cuba, with but half the number of his reckless companions. He

From "Mexico, Aztec, Spanish, and Republican." By Brantz Mayer.

WAITING THE RETURN OF THE TRAVELER

AFTER THE PAINTING BY EDITH HUME

"Joy! the lost one is restor'd!
Sunshine comes to hearth and board.
From the far-off countries old,
Of the diamond and red gold,
From the dusty archer bands,
Roamers of the desert sands,
He hath reached his home again."

—Mrs. Hemans.

brought back with him, however, numerous evidences of the wealth and progress of the people he had fortuitously discovered on the American main; but he soon died, and left to others the task of completing the enterprise he had so auspiciously begun. The fruits of his discoveries remained to be gathered by Velasquez, who at once equipped four vessels and entrusted them to the command of his nephew, Juan de Grijalva, and on the 1st of May, 1518, this new commander left the port of St. Jago de Cuba. The first land he touched on his voyage of discovery, was the island of Cozumel, whence he passed to the continent, glancing at the spots that had been previously visited by Cordova. So struck was he by the architecture, the improved agriculture, the civilized tastes, the friendly character and demeanor of the inhabitants, and, especially, by the sight of "large stone crosses, evidently objects of worship," that, in the enthusiasm of the moment, he gave to the land the name of Nueva España — or New Spain — a title which has since been extended from the peninsula of Yucatan to even more than the entire empire of Montezuma and the Aztecs.

Grijalva did not content himself with a mere casual visit to the continent, but pursued his course along the coast, stopping at the Rio de Tabasco. Whilst at Rio de Vanderas, he enjoyed the first intercourse that ever took place between the Spaniards and Mexicans. The *Cacique* of the Province sought from the strangers a full account of their distant country and the motives of their visit, in order that he might convey the intelligence to his Aztec master. Presents were interchanged, and Grijalva received, in return for his toys and tinsel, a mass of jewels, together with ornaments and vessels of gold, which satisfied the adventurers that they had reached a country whose resources would repay them for the toil of further exploration. Accordingly, he despatched to Cuba with the joyous news, Pedro de Alvarado, one of his captains — a man who was destined to play a conspicuous part in the future conquest — whilst he, with the remainder of his companies, continued his coasting voyage to San Juan

de Ulua, the Island of Sacrificios, and the northern shores, until he reached the Province of Panuco; whence, after an absence of six months, he set sail for Cuba, having been the first Spanish adventurer who trod the soil of Mexico.

But his return was not hailed even with gratitude. The florid reports of Pedro de Alvarado had already inflamed the ambition and avarice of Velasquez, who, impatient of the prolonged absence of Grijalva, had despatched a vessel under the command of Olid in search of his tardy officer. Nor was he content with this jealous exhibition of his temper; for, anxious to secure to himself all the glory and treasure to be derived from the boundless resources of a continent, he solicited authority from the Spanish crown to prosecute the adventures that had been so auspiciously begun; and, in the meanwhile after considerable deliberation, resolved to fit out another armament on a scale, in some degree, commensurate with the military subjugation of the country, should he find himself opposed by its sovereign and people. After considerable doubt, difficulty and delay, he resolved to entrust this expedition to the command of Hernando Cortéz; "the last man," says Prescott, "to whom Velasquez — could he have foreseen the results — would have confided the enterprise."

As soon as Cortéz reached Hispaniola, he visited the Governor, whom he had formerly known at home. Ovando was absent, but his secretary received the emigrant kindly, and assured him "a liberal grant of land." "I come for *gold*," replied Cortéz, sneeringly, "and not to toil like a peasant!" Ovando, however, was more fortunate than the secretary, in prevailing upon the future conqueror to forego the lottery of adventure, for no sooner had he returned to his post, than Cortéz was persuaded to accept a grant of land, a *repartimiento* of Indians, and the office of notary in the village of Açua. Here he seems to have dwelt until 1511, varying the routine of notarial and agricultural pursuits by sometimes taking part in the military expeditions under Diego

Velasquez for the suppression of Indian insurrections in the interior. This was the school in which he learned his tactics, and here did he study the native character until he joined Velasquez for the conquest of Cuba.

As soon as this famous Island was reduced to Spanish authority, Cortéz became high in favor with Velasquez, who had received the commission of Governor. But love, intrigues, jealousy and ambition, quickly began to checker the wayward life of our hero, and estranged him from Velasquez, for the new Governor found it difficult to satisfy the cravings of those rapacious adventurers who flocked in crowds to the New World, and, in all probability, clustered around Cortéz as the nucleus of discontent. It was soon resolved by these men to submit their complaints against Velasquez to the higher authorities in Hispaniola, and the daring Cortéz was fixed on as the bearer of the message in an open boat, across the eighteen intervening leagues. But the conspiracy was detected — the rash ambassador confined in chains — and only saved from hanging by the interposition of powerful friends.

Cortéz speedily contrived to relieve himself of the fetters with which he was bound, and, forcing a window, escaped from his prison to the sanctuary of a neighboring church. A few days after, however, he was seized whilst standing carelessly in front of the sacred edifice, and conveyed on board a vessel bound for Hispaniola, where he was to be tried. But his intrepidity and skill did not forsake him even in this strait. Ascending cautiously from the vessel's hold to the deck, he dropped into a boat and pulled near ashore, when dreading to risk the frail bark in the breakers, he abandoned his skiff — plunged boldly into the surf — and landing on the sands, sought again the sanctuary, whence he had been rudely snatched by the myrmidons of the Governor. . . .

The future conqueror devoted himself henceforth to his duties with remarkable assiduity. Agriculture — the introduction of cattle of the best breeds — and the revenues of a share of the mines which he wrought — soon began

to enrich the restless adventurer who had settled down for a while into the quiet life of a married man. His beautiful wife fulfilled her share of the cares of life with remarkable fidelity, and seems to have contented the heart even of her liege lord who declared himself as happy with his bride as if she had been the daughter of a duchess.

At this juncture Alvarado returned with the account of the discoveries, the wealth, and the golden prospects of continental adventure which we have already narrated. Cortéz and Velasquez were alike fired by the alluring story. The old flame of enterprise was rekindled in the breast of the wild boy of Medellin, and when the Governor looked around for one who could command the projected expedition, he found none, among the hosts who pressed for service, better fitted for the enterprise by personal qualities and fortune, than Hernando Cortéz, whom he named Captain-General of his Armada. . . .

Six ships and three hundred followers were soon prepared for the enterprise under Cortéz, and the Governor proceeded to give instructions to the leader, all of which are couched in language of unquestionable liberality.

The captain of the Armada was first to seek the missing Grijalva, after which the two commanders were to unite in their quest of gold and adventure. Six Christians, supposed to be lingering in captivity in Yucatan, were to be sought and released. Barter and traffic, generally, with the natives were to be encouraged and carried on, so as to avoid all offence against humanity or kindness. The Indians were to be christianized; for the conversion of heathens was one of the dearest objects of the Spanish king. The Aborigines, in turn, were to manifest their good will by ample gifts of jewels and treasure. The coasts and adjacent streams were to be surveyed — and the productions of the country, its races, civilization, and institutions, were to be noted with minute accuracy, so that a faithful report might be returned to the crown, to whose honor and the service of God, it was hoped the enterprise would certainly redound.

Such was the state of things in the port of St. Jago,

when jealous fears began to interrupt the confidence between Velasquez and Cortéz. The counsel of friends who were companions of the Governor, and his own notice of that personage's altered conduct, soon put the new Captain General of the Armada on his guard. Neither his equipment nor his crew was yet complete; nevertheless, he supplied his fleet with all the provisions he could hastily obtain at midnight; and, paying the provider with a massive chain which he had worn about his neck — the last available remnant, perhaps, of his fortune — he hastened with his officers on board the vessels.

On the 18th of November, 1518, he made sail for the port of Macaca, about fifteen leagues distant, and thence he proceeded to Trinidad, on the southern coast of Cuba. Here he obtained stores from the royal farms, whilst he recruited his forces from all classes, but especially from the returned troops and sailors of Grijalva's expedition. Pedro de Alvarado and his brothers; Cristóval de Olid, Alonzo de Avila, Juan Velasquez de Leon, Hernandez de Puerto Carrero, and Gonzalo de Sandoval, united their fortunes to his, and thus identified themselves forever with the conquest of Mexico. He added considerably to his stock by the seizure of several vessels and cargoes; and prudently got rid of Diego de Ordaz, whom he regarded as a spy of the estranged Velasquez.

At Trinidad, Cortéz was overtaken by orders for detention from his former friend and patron. These commands, however, were not enforced by the cautious official who received them; and Cortéz, forthwith, despatched Alvarado, by land, to Havana, whilst he prepared to follow with his fleet around the coast and western part of the island. At Havana he again added to his forces — prepared arms and quilted armor as a defence against the Indian arrows — and distributed his men into eleven companies under the command of experienced officers. But, before all his arrangements were completed, the commander of the place, Don Pedro Barba, was ordered, by express from Velasquez, to *arrest* Cortéz, whilst the Captain General of the Armada himself received a hyp-

critical letter from the same personage, "requesting him to delay his voyage till the governor could communicate with him in person!" Barba, however, knew that the attempt to seize the leader of such an enterprise and of such a band, would be vain; whilst Cortéz, in reply to Velasquez, "implored his Excellency to rely on his boundless devotion to the interests of his Governor, but assured him, nevertheless, that he and his fleet, by divine permission, would sail on the following day!"

Accordingly, on the 18th of February, 1519, the little squadron weighed anchor, with one hundred and ten mariners, sixteen horses, five hundred and fifty-three soldiers, including thirty-two crossbowmen and thirteen arquebusiers, besides two hundred Indians of the island and a few native women, for menial offices. The ordnance consisted of ten heavy guns, four lighter pieces of falconets, together with a good supply of ammunition.

With this insignificant command and paltry equipment, Hernando Cortéz, at the age of thirty-three, set sail for the conquest of Mexico. He invoked on his enterprise the blessing of his patron, Saint Peter; he addressed his followers in the language of encouragement and resolution; he unfurled a velvet banner on which was emblazoned the figure of a crimson cross amid flames of blue and white, and he pointed to the motto which was to be the presage of victory: "Friends, let us follow the Cross: and under this sign, if we have faith, we shall conquer!"

Soon after the adventurers departed from the coast of Cuba, the weather, which had been hitherto fine, suddenly changed, and one of those violent hurricanes which ravage the Indian Isles during the warm season, scattered and dismantled the small squadron, sweeping it far to the south of its original destination. Cortéz was the last to reach the Island of Cozumel, having been forced to linger in order to watch for the safety of one of his battered craft. But, immediately on landing, he was pained to learn that the impetuous Pedro de Alvarado had rashly entered the temples, despoiled them of their ornaments, and terrified the natives into promiscuous

flight. He immediately devoted himself to the task of obliterating this stain on Spanish humanity, by kindly releasing two of the captives taken by Alvarado. Through an interpreter he satisfied them of the pacific purpose of his voyage, and despatched them to their homes with valuable gifts. This humane policy appears to have succeeded with the natives, who speedily returned from the interior, and commenced a brisk traffic of gold for trinkets. . . .

After the vessels were refitted, Cortéz coasted the shores of Yucatan until he reached the Rio de Tabasco or Grijalva, where he encountered the first serious opposition to the Spanish arms. He had a severe conflict, in the vicinity of his landing, with a large force of the natives; but the valor of his men, the terror inspired by fire arms, and the singular spectacle presented to the astonished Indians by the extraordinary appearance of cavalry, soon turned the tide of victory in his favor. The subdued tribes appeased his anger by valuable gifts, and forthwith established friendly relations with their dreaded conqueror. Among the presents offered upon this occasion by the vanquished, were twenty female slaves; and after one of the holy fathers had attempted, as usual, to impress the truths of Christianity upon the natives, and had closed the ceremonies of the day by a pompous procession, with all the impressive ceremonial of the Roman church, the fleet again sailed toward the empire Cortéz was destined to penetrate and subdue.

In Passion week, of the year 1519, the squadron dropped anchor under the lee of the Island or reef of St. Juan de Ulua. The natives immediately boarded the vessel of the Captain General; but their language was altogether different from that of the Mayan dialects spoken in Yucatan and its immediate dependencies. In this emergency Cortéz learned that, among the twenty female slaves who had been recently presented him, there was one who knew the Mexican language, and, in fact, that she was an Aztec by birth. This was the celebrated Marina or Mariana, who accompanied the conqueror

throughout his subsequent adventures, and was so useful as a sagacious friend and discreet interpreter. Acquainted with the languages of her native land and of the Yucatecos, she found it easy to translate the idiom of the Aztecs into the Mayan dialect which Aguilar, the Spaniard, had learned during his captivity. Through this medium, Cortéz was apprised that these Mexicans or Aztecs were the subjects of a powerful sovereign who ruled an empire bounded by two seas, and that his name was Montezuma.

On the 21st of April the Captain General landed on the sandy and desolate beach whereon is now built the modern city of Vera Cruz. Within a few days the native Governor of the province arrived to greet him, and expressed great anxiety to learn whence the "fair and bearded strangers" had come? Cortéz told him that he was the "subject of a mighty monarch beyond the sea who ruled over an immense empire and had kings and princes for his vassals; that, acquainted with the greatness of the Mexican emperor, his master desired to enter into communication with so great a personage, and had sent him, as an envoy, to wait on Montezuma with a present in token of his good will, and a friendly message which he must deliver in person." The Indian Governor expressed surprise that there was another king as great as his master, yet assured Cortéz that as soon as he learned Montezuma's determination, he would again converse with him on the subject. Teuhtle then presented the Captain General ten loads of fine cottons; mantles of curious feather work, beautifully dyed; and baskets filled with golden ornaments. Cortéz, in turn, produced the gifts for the emperor, which were comparatively insignificant; but, when the Aztec Governor desired to receive the glittering helmet of one of the men, it was readily given as an offering to the emperor, with the significant request that it might be returned filled with gold, which Cortéz told him was "a specific remedy for a disease of the heart with which his countrymen, the Spaniards, were sorely afflicted!"

During this interview between the functionaries it was noticed by the adventurers that men were eagerly employed among the Indians in sketching every thing they beheld in the ranks of the strangers — for, by this picture-writing, the Mexican monarch was to be apprised in accurate detail of the men, horses, ships, armor, force, and weapons of this motley band of invaders.

These pictorial missives were swiftly borne by the Mexican couriers to the Aztec capital among the mountains, and, together with the oral account of the landing of Cortéz and his demand for an interview, were laid before the Imperial Court. . . .

When the news of Cortéz's arrival became the subject of discussion in Mexico, some were for open or wily resistance. Others were oppressed with superstitious fears. But Montezuma, adopting a medium but fatal course, resolved, without delay, to send an embassy with such gifts as he imagined would impress the strangers with the idea of his magnificence and power, whilst, at the same time, he courteously commanded the adventurers to refrain from approaching his capital.

Meanwhile the Spaniards restlessly endured the scorching heat and manifold annoyances of the coast, and were amusing themselves by a paltry traffic with the Indians, whose offerings were generally of but trifling value. After the expiration of a week, however, the returned couriers and the embassy approached the camp. The time is seemingly short when we consider the difficulty of transportation through a mountain country, and recollect that the Mexicans, who were without horses, had been obliged to traverse the distance on foot. But it is related on ample authority — so perfectly were the posts arranged among these semi-civilized people — that tidings were borne in the short period of twenty-four hours from the city to the sea, and consequently, that three or four days were ample for the journey of the envoys of Montezuma, upon a matter of so much national importance.

The two Aztec nobles, accompanied by the Governor of the province, Teuhtle, did not approach with empty hands

the men whom they hoped to bribe if they could not intimidate. Gold and native fabrics of the most delicate character; shields, helmets, cuirasses, collars, bracelets, sandals, fans, pearls, precious stones; loads of cotton cloth, extraordinary manufactures of feathers, circular plates of gold and silver as large as carriage wheels, and the Spanish helmet filled with golden grains; were all spread out, as a free gift from the Emperor to the Spaniards!

With these magnificent presents, Montezuma replied to the request of Cortéz, that it would give him pleasure to communicate with so mighty a monarch as the king of Spain, whom he respected highly, but that he could not gratify himself by according the foreign envoy a personal interview, inasmuch as the distance to his capital was great, and the toilsome journey among the mountains was beset with dangers from formidable enemies. He could do no more, therefore, than bid the strangers farewell, and request them to return to their homes over the sea with these proofs of his perfect friendship.

It may well be supposed that this naïve system of diplomacy could have but little effect on men who were bent on improving their fortunes, and whose rapacity was only stimulated by the evidences of unbounded wealth which the simple-minded king had so lavishly bestowed on them. Montezuma was the dupe of his own credulity, and only inflamed, by the very means he imagined would assuage the avarice or ambition of his Spanish visitors. Nor was Cortéz less resolved than his companions. Accordingly he made another pacific effort, by means of additional presents and a gentle message, to change the resolution of the Indian emperor. Still the Aztec sovereign was obstinate in his refusal of a personal interview, although he sent fresh gifts by the persons who bore to the Spaniards his polite but firm and peremptory denial.

Cortéz could hardly conceal his disappointment at this second rebuff; but, as the vesper bell tolled, whilst the ambassadors were in his presence, he threw himself on his knees with his soldiers, and, after a prayer, Father

Olmedo expounded to the Aztec chiefs, by his interpreters, the doctrines of Christianity, and putting into their hands an image of the Virgin and Saviour, he exhorted them to abandon their hideous idolatry, and to place these milder emblems of faith and hope on the altars of their bloody gods. That very night the Indians abandoned the Spanish camp and the neighborhood, leaving the adventurers without the copious supplies of food that hitherto had been bountifully furnished. Cortéz, nevertheless, was undismayed by these menacing symptoms, and exclaimed to his hardy followers: "It shall yet go hard, but we will one day pay this powerful prince a visit in his gorgeous capital!"

Cortéz was not long idle after the withdrawal of the Aztec emissaries and the surly departure of the Indians. He forthwith proceeded to establish a military and civil colony, of which he became Capain General and Chief Justice; he founded the Villa Rica de la Vera Cruz in order to secure a base on the coast for future military operation, by means of which he might be independent of Velasquez; and he formed an alliance with the Totonacos of Cempoalla, whose loyalty — though they were subjects of Montezuma — was alienated from him by his merciless exactions. The most daring act of this period was the destruction of the squadron which had wafted him to Mexico. It was a deed of wise policy, which deliberately cut off all hope of retreat — pacified, in some degree, the querulous conspirators who lurked in his camp — and placed before all who were embarked in the enterprise the alternative of conquest or destruction. But one vessel remained. Nine out of the ten were dismantled and sunk. When his men murmured for a moment, and imagined themselves betrayed, he addressed them in that language of bland diplomacy which he was so well skilled to use whenever the occasion required. "As for me," said he, "I will remain *here* whilst there is one to bear me company! Let the cravens shrink from danger and go home in the single vessel that remains. Let them hasten to Cuba, and relate how they deserted their commander and

comrades; and there let them wait in patience till we return laden with the spoils of Mexico!"

This was an appeal that rekindled the combined enthusiasm and avarice of the despondent murmurers; and the reply was a universal shout: "To Mexico! to Mexico!"

On the 16th of August, 1519, Cortéz set out with his small army of about four hundred men, now swelled by the addition of thirteen hundred Indian warriors and a thousand porters, and accompanied by forty of the chief Totonacs as hostages and advisers. From the burning climate of the coast the army gradually ascended to the cooler regious of the *tierra templada,* and *tierra fria,* encountering all degrees of temperature on the route. After a journey of three days, the forces arrived at a town on one of the table lands of the interior, whose chief magistrate confirmed the stories of the power of Montezuma. Here Cortéz tarried three days for repose, and then proceeded towards the Republic of Tlascala, which lay directly in his path, and with whose inhabitants he hoped to form an alliance founded on the elements of discontent which he knew existed among these inveterate foes of the central Aztec power. But he was mistaken in his calculations. The Tlascalans were not so easily won as his allies, the Totonacs, who, dwelling in a warmer climate, had not the hardier virtues of these mountaineers. The Tlascalans entertained no favorable feeling towards Montezuma, but they nourished quite as little cordiality for men whose characters they did not know, and whose purposes they had cause to dread. A deadly hostility to the Spaniards was consequently soon manifested. Cortéz was attacked by them on the borders of their Republic, and fought four sharp battles with fifty thousand warriors who maintained, in all the conflicts, their reputation for military skill and hardihood. At length the Tlascalans were forced to acknowledge the superiority of the invaders, whom they could not overcome either by stratagem or battle, and, after the exchange of embassies and gifts, they honored our hero with a triumphal entry into their capital.

The news of these victories as well as of the fatal alliance which ensued with the Tlascalans, was soon borne to the court of Montezuma, who began to tremble for the fate of his empire when he saw the fall of the indomitable foes who had held him so long at bay. Two embassies to Cortéz succeeded each other, in vain. Presents were no longer of avail. His offer of tribute to the Spanish king was not listened to. All requests that the conqueror should not advance towards his capital were unheeded. "The command of his own emperor," said Cortéz, "was the only reason which could induce him to disregard the wishes of an Aztec prince, for whom he cherished the profoundest respect!" Soon after, another embassy came from Montezuma with magnificent gifts and an invitation to his capital, yet with a request that he would break with his new allies and approach Mexico through the friendly city of Cholula. The policy of this request on the part of Montezuma, will be seen in the sequel. Our hero, accompanied by six thousand volunteers from Tlascala, advanced towards the sacred city — the site of the most splendid temple in the empire, whose foundations yet remain in the nineteenth century. The six intervening leagues were soon crossed, and he entered Cholula with his Spanish army, attended by no other Indians than those who accompanied him from Cempoalla. At first, the General and his companions were treated hospitably, and the suspicions which had been instilled into his mind by the Tlascalans were lulled to sleep. However, he soon had cause to become fearful of treachery. Messengers arrived from Montezuma, and his entertainers were observed to be less gracious in their demeanor. It was noticed that several important streets had been barricaded or converted into pitfalls, whilst stones, missiles and weapons were heaped on the flat roofs of houses. Besides this, Mariana had become intimate with the wife of one of the Caciques, and cunningly drew from her gossiping friend the whole conspiracy that was brewing against the adventurers. Montezuma, she learned, had stationed twenty thousand Mexicans near the city, who

together with the Cholulans, were to assault the invaders in the narrow streets and avenues, as they quitted the town; and, thus, he hoped, by successful treachery, to rid the land of such dangerous visitors either by slaughter in conflict, or to offer them, when made captive, upon the altars of the sacred temple in Cholula and on the *teocallis* of Mexico, as proper sacrifices to the bloody gods of his country.

Cortéz, however, was not to be so easily outwitted and entrapped. He, in turn, resorted to stratagem. Concentrating all his Spanish army, and concerting a signal for co-operation with his Indian allies, he suddenly fell upon the Cholulans at an unexpected moment. Three thousand of the citizens perished in the frightful massacre that ensued; and Cortéz pursued his uninterrupted way towards the fated capital of the Aztecs, after this awful chastisement, which was perhaps needful to relieve him from the danger of utter annihilation in the heart of an enemy's country with so small a band of countrymen in whom he could confide.

From the plain of Cholula — which is now known as the fruitful vale of Puebla — the conqueror ascended the last ridge of mountains that separated him from the city of Mexico; and, as he turned the edge of the *Cordillera,* the beautiful valley was at once revealed to him in all its indescribable loveliness.[1] It lay at his feet, surrounded by the placid waters of Tezcoco. The sight that burst upon the Spaniards from this lofty eminence, in the language of Prescott, was that of the vale of Tenochtitlan, as it was called by the natives, "which, with its picturesque assemblage of water, woodland, and cultivated planes; its shining cities and shadowy hills, was spread out like some gay and gorgeous panorama before them. In the highly rarefied atmosphere of these upper regions, even remote objects have a brilliancy of coloring and a distinctness of outline which seems to annihilate distance. Stretching far away at their feet, were seen

[1] Between nine and ten thousand feet above the level of the sea, at this point of the road.

noble forests of oak, sycamore, and cedar; and beyond, yellow fields of maize and the towering maguey, intermingled with orchards and blooming gardens; for flowers, in such demand for their religious festivals, were even more abundant in this populous valley, than in other parts of Anahuac. In the center of the great basin, were beheld the lakes, occupying then a much larger portion of its surface then at present; their borders thickly studded with towns and hamlets, and, in the midst — like some Indian empress with her coronal of pearls — the fair city of Mexico, with her white towers and pyramidal temples reposing, as it were, on the bosom of the waters — the far-famed 'Venice of the Aztecs.' High over all rose the royal hill of Chapultepec, the residence of the Mexican monarchs, belted with the same grove of gigantic cypresses, which at this day fling their broad shadows over the land. In the distance, to the north, beyond the blue waters of the lake, and nearly screened by intervening foliage, was seen a shining speck, the rival capital of Tezcoco; and, still further on, the dark belt of porphyry, girdling the valley around, like a rich setting which Nature had devised for the fairest of her jewels."

Cortéz easily descended with his troops by the mountain road toward the plain of the valley; and as he passed along the levels, or through the numerous villages and hamlets, he endeavored to foster and foment the ill feeling which he found secretly existing against the government of the Mexican Emperor. When he had advanced somewhat into the heart of the valley he was met by an embassy of the chief lords of the Aztec court, sent to him by Montezuma, with gifts of considerable value; but he rejected a proffered bribe of "four loads of gold to the General, and one to each of his captains, with a yearly tribute to their sovereign," provided the Spanish troops would quit the country. Heedless of all menaced opposition as well as appeals to his avarice, he seems, at this period, to have cast aside the earlier and sordid motives which might then have been easily satisfied had his pursuit been gold alone. The most abundant wealth was

cast at his feet; but the higher qualities of his nature were now allowed the fullest play, and strengthened him in his resolution to risk all in the daring and glorious project of subjecting a splendid empire to his control. Accordingly, he advanced through Amaquemecan, a town of several thousand inhabitants, where he was met by a nephew of the Emperor, the Lord of Tezcoco, who had been despatched by his vacillating uncle, at the head of a large number of influential personages, to welcome the invaders to the capital. The friendly summons was of course not disregarded by Cortéz, who forthwith proceeded along the most splendid and massive structure of the New World — a gigantic causeway, five miles in length, constructed of huge stones, which passed along the narrow strait of sand which separated the waters of Chalco from those of Tezcoco. The lakes were covered with boats filled with natives. Floating islands, made of reeds and wicker-work, covered with soil, brimmed with luxuriant vegetation whose splendid fruits and odorous petals rested on the waters. Several large towns were built on artificial foundations in the lake. And, every where, around the Spaniards, were beheld the evidences of a dense population, whose edifices, agriculture, and labors denoted a high degree of civilization and intelligence. As the foreign warriors proceeded onwards towards the city, which rose before them with its temples, palaces and shrines, covered with hard stucco that glistened in the sun, they crossed a wooden drawbridge in the causeway; and, as they passed it, they felt that now, indeed, if they faltered, they were completely in the grasp of the Mexicans, and more effectually cut off from all retreat than they had been when the fleet was destroyed at Vera Cruz.

Near this spot they were encountered by Montezuma with his court, who came forth in regal state to salute his future conqueror. Surrounded by all the pageantry and splendor of an oriental monarch, he descended from the litter in which he was borne from the city, and, leaning on the shoulders of the Lords of Tezcoco and of Iztapala-

pan — his nephew and brother — he advanced towards the Spaniards, under a canopy and over a cotton carpet, whilst his prostrate subjects manifested, by their abject demeanor, the fear or respect which the presence of their sovereign inspired.

As this mighty prince approached, Cortéz halted his men, and, advancing with a few of his principal retainers, was most courteously welcomed by Montezuma, who, adroitly concealing his chagrin, diplomatically expressed the uncommon delight he experienced at this unexpected visit of the strangers to his capital. Our hero thanked him for his friendly welcome and bounteous gifts, and hung around his neck a chain set with colored crystal. Montezuma then opened his gates to the Spaniards and appointed his brother to conduct the General with his troops, to the city.

Here he found a spacious edifice, surrounded by a wall, assigned for his future residence; and, having stationed sentinels, and placed his cannon on the battlements so as to command all the important avenues to his palace, he proceeded to examine the city and to acquaint himself with the character, occupations, and temper of the people.

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## CHRISTOPHER COLUMBUS.

THE mariner's compass, invented, according to the generally received opinion, about 1302, by one Flavio Gioja of Amalfi, enabled vessels to sail at a distance from the coasts, and to guide themselves when out of sight of land. Martin Behaim, with two physicians in the service of Prince Henry of Portugal, had also added to nautical science by discovering the way of directing the voyager's course according to the position of the sun in the heavens, and by applying the astrolabe to the purposes of navigation. These improvements being adopted, the commercial question of the western route in-

creased daily in importance in Spain, Portugal and Italy, countries in which three-quarters of the science is made up of imagination. There was discussion, there were writings. The excited world of commerce disputed with the world of science. Facts, systems, doctrines, were grouped together. The time was come when there was needed one single intelligence to collect together and assimilate the various floating ideas. This intelligence was found. At length all the scattered notions were gathered together in the mind of one man, who possessed in a remarkable degree genius, perseverance, and boldness.

This man was no other than Christopher Columbus, born, probably near Genoa, about the year 1436. We say "probably," for the towns of Cogoreo and Nervi dispute with Savona and Genoa, the honor of having given him birth. The date of his birth varies, with different biographers, from 1430 to 1445, but the year 1436 would appear to be the correct one, according to the most reliable documents. The family of Columbus was of humble origin; his father, Domenic Columbus, a manufacturer of woollen stuffs, seems, however, to have been in sufficiently easy circumstances to enable him to give his children a more than ordinary good education. The young Christopher, the eldest of the family, was sent to the University of Pavia, there to study Grammar, Latin, Geography, Astronomy, and Navigation.

At fourteen years of age Christopher left school and went to sea; from this time until 1487, very little is known of his career. The most probable account to be gathered from contemporary documents and from the writings of Columbus himself, is that the young sailor visited the Levant, the west, the north, England several times, Portugal, the coast of Guinea, and the islands off Africa, perhaps even Greenland, for by the age of forty, "he had sailed to every part that had ever been sailed to before." He was looked upon as a thoroughly competent mariner, and his reputation led to his being chosen for the command of the Genoese galleys in the war which that Republic was waging against Venice. He afterward made an ex-

pedition, in the service of René, king of Anjou, to the coasts of Barbary, and in 1477, he went to explore the countries beyond Iceland.

This voyage being successfully terminated, Christopher Columbus returned to his home in Lisbon. He there married the daughter of an Italian gentleman, Bartolomeo Munêz Perestrello, a sailor like himself and deeply interested in the geographical ideas of the day. The wife of Columbus, Doña Filippa, was without fortune, and Columbus, having none himself, felt he must work for the support of himself and his family. The future discoverer, therefore, set to work to make picture-books, terrestrial globes, maps, and nautical charts, and continued in this employment until 1484, but without at the same time abandoning his scientific and literary pursuits. It seems probable even, that during this period he studied deeply, and attained to knowledge far beyond that possessed by most of the sailors of his time. Can it have been that at this time "the Great Idea" first arose in his mind? It may have been so. He was following assiduously the discussions relative to the western routes, and the facility of communication by the west, between Europe and Asia. His correspondence proves that he shared the opinion of Aristotle as to the relatively short distance separating the extreme shores of the old Continent. He wrote frequently to the most distinguished savants of his time. Martin Béhaim, of whom we have already spoken, was among his correspondents, and also the celebrated Florentine astronomer, Toscanelli, whose opinions in some degree influenced those of Columbus.

At this time Columbus was a tall man, of robust and noble presence. His face was long, he had an aquiline nose, high cheek-bones, eyes clear and full of fire; he had a bright complexion, and his face was much covered with freckles. . . .

At the time when Christopher Columbus was in correspondence with the astronomer Toscanelli, he learned that the latter, at the request of Alphonso V., King of Portugal, had sent to the king a learned Memoir upon the possi-

bility of reaching the Indies by the western route. Columbus was consulted, and supported the ideas of Toscanelli with all his influence; but without result, for the King of Portugal who was engaged at the time in war with Spain, died, without having been able to give any attention to maritime discoveries. His successor, John II., adopted the plans of Columbus and Toscanelli with enthusiasm. At the same time, with most reprehensible cunning, he tried to deprive these two savants of the benefit of their proposition; without telling them, he sent out a caravel to attempt this great enterprise, and to reach China by crossing the Atlantic. But he had not reckoned upon the inexperience of his pilots, nor upon the violence of the storms which they might encounter; the result was, that some days after their departure, a hurricane brought back to Lisbon the sailors of the Portuguese king. Columbus was justly wounded by this unworthy action, and felt that he could not reckon upon a king who had so deceived him. His wife being dead, he left Spain with his son Diego, toward the end of the year 1484. It is thought that he went to Genoa and to Venice, where his projects of transoceanic navigation were but badly received.

However it may have been, in 1485 we find him again in Spain. This great man was poor, without resources. He travelled on foot, carrying Diego, his little son of ten years old, in his arms. From this period of his life, history follows him step by step; she no more loses sight of him, and she has preserved to posterity the smallest incidents of this grand existence. We find Columbus arrived in Andulasia, only half a league from the port of Palos. Destitute, and dying of hunger, he knocked at the door of a Franciscan convent, dedicated to Santa Maria de Rabida, and asked for a little bread and water for his poor child and for himself. The superior of the convent, Juan Perez de Marchena, gave hospitality to the unfortunate traveller. He questioned him, and was surprised by the nobleness of his language, but still more astonished was he by the boldness of the ideas of Colum-

bus, who made the good Father the confidant of his aspirations. For several months the wandering sailor remained in this hospitable convent; some of the monks were learned men, and interested themselves about him and his projects; they studied his plans; they mentioned him to some of the well-known navigators of the time; and we must give them the credit of having been the first to believe in the genius of Christopher Columbus. Juan Perez showed still greater kindness; he offered to take upon himself the charge of the education of Diego, and gave to Columbus a letter of recommendation addressed to the confessor of the Queen of Castile.

This confessor, prior of the monastery of Prado, was deep in the confidence of Ferdinand and Isabella; but he did not approve of the projects of the Genoese navigator, and he rendered him no service whatever with his royal penitent. Columbus must still resign himself to wait. He went to live at Cordova, where the court was soon to come, and for livelihood he resumed his trade of picture-seller. Is it possible to quote from the lives of illustrious men an instance of a more trying existence than this of the great navigator? Could ill-fortune have assailed any man with more cruel blows? But this indomitable, indefatigable man of genius, rising up again after each trial, did not despair. He felt within him the sacred fire of genius, he worked on unceasingly, he visited influential persons, spreading his ideas and defending them, and combating all objections with the most heroic energy. At length he obtained the protection of the great cardinal-archbishop of Toledo, Pedro Gonzalez de Mendoza, and thanks to him, was admitted into the presence of the King and Queen of Spain.

Christopher Columbus must have imagined himself at the end of all his troubles. Ferdinand and Isabella received his project favorably, and caused it to be submitted for examination to a council of learned men, consisting of bishops and monks who were gathered together *ad hoc* in a Dominican convent at Salamanca. But the unfortunate pleader was not yet at the end of his vicissi-

tudes. In this meeting at Salamanca all his judges were against him. The truth was, that his ideas interfered with the religious notions of the fifteenth century. The Fathers of the Church had denied the sphericity of the earth, and since the earth was not round they declared that a voyage of circumnavigation was absolutely contrary to the Bible, and could not therefore, on any logical theory, be undertaken. "Besides," said these theologians, "if any one should ever succeed in descending into the other hemisphere how could he ever mount up again into this one?" This manner of arguing was a very formidable one at this period; for Christopher Columbus saw himself, in consequence, always accused of heresy, the most unpardonable crime which could be committed in this far off intolerant time. He escaped any evil consequences from the hostile disposition of the Council, but the execution of his project was again adjourned.

Long years passed away. The unfortunate man of genius, despairing of success in Spain, sent his brother to England to make an offer of his services to the king, Henry VII. But it is probable that the king gave no answer. Then Christopher Columbus turned again with unabated perseverance to Ferdinand, but Ferdinand was at this time engaged in a war of extermination against the Moors, and it was not until 1492, when he had chased the Moors from Spain, that he was able again to listen to the solicitations of the Genoese sailor.

This time the affair was thoroughly considered and the king consented to the enterprise. But Columbus, as is the manner of proud natures, wished to impose his own conditions. They bargained over that which should enrich Spain! Columbus, in disgust, was without doubt ready to quit, and forever, this ungrateful country, but Isabella, touched by the thought of the unbelievers of Asia, whom she hoped to convert to the Catholic faith, ordered Columbus to be recalled, and then acceded to all his demands.

Columbus was in the fifty-sixth year of his age when he signed a treaty with the King of Spain at Santa Fé on

the 17th of April, 1492, being eighteen years after he had first conceived his project, and seven years from the time of his quitting the monastery of Palos. By this solemn convention, the dignity of high admiral was to belong to Columbus in all the lands which he might discover, and this dignity was to descend in perpetuity to his heirs and successors. He was named viceroy and governor of the new possessions which he hoped to conquer in the rich countries of Asia, and one-tenth part of the pearls, precious stones, gold, silver, spices, provisions, and merchandise of whatever kind, which might be acquired in any manner whatsoever, within the limits of his jurisdiction, was of right to belong to him.

All was arranged, and at length Columbus was to put his cherished projects in execution. But let us repeat, he had no thought of meeting with the New World, of the existence of which he had not the faintest suspicion. His aim was to " explore the East by the West, and to pass by the way of the West to the Land whence comes the spices." One may even aver that Columbus died in the belief that he had arrived at the shores of Asia, and never knew himself that he had made the discovery of America. But this in no way lessens his glory; the meeting with the new Continent was but an accident. The real cause of the immortal renown of Columbus was that audacity of genius which induced him to brave the dangers of an unknown ocean, to separate himself afar from those familiar shores, which, until now, navigators had never ventured to quit, to adventure himself upon the waves of the Atlantic Ocean in the frail ships of the period, which the first tempest might engulf, to launch himself, in a word, upon the deep darkness of an unknown sea.

The preparations began, Columbus entering into an arrangement with some rich navigators of Palos, the three brothers Pinzon, who made the necessary advances for defraying the expenses of fitting out the ships. Three caravels, named the " Gallega," the " Niña," and the " Pinta," were equipped in the port of Palos. The "Gallega " was destined to carry the admiral, who changed

her name to the "Santa-Maria." The "Pinta" was commanded by Martin Alonzo Pinzon, and the "Niña" by his two brothers, Francis Martin, and Vincent Yanez Pinzon. It was difficult to man the ships, sailors generally being frightened at the enterprise, but at last the captains succeeded in getting together one hundred and twenty men, and on Friday, August 3, 1492, the admiral, crossing at eight o'clock in the morning the bar of Saltez, off the town of Huelva, in Andalusia, adventured himself with his three half-decked caravels upon the Atlantic waves.

During the first day's voyage, the admiral—the title by which he is usually known in the various accounts of his exploits—bearing directly southward, sailed forty-five miles before sunset; turning then directly to the southeast, he steered for the Canaries, in order to repair the "Pinta," which had unshipped her rudder, an accident caused perhaps by the ill-will of the steersman, who dreaded the voyage. Ten days later Columbus cast anchor before the Great Canary Island, where the rudder of the caravel was repaired. Nineteen days afterward he arrived before Gomera, where the inhabitants assured him of the existence of an unknown land in the west of the Archipelago. He did not leave Gomera until the 6th of September. He had received warning that three Portuguese ships awaited him in the open sea, with the intention of barring his passage; however, without taking any heed of this news, he put to sea, cleverly avoided meeting his enemies, and steering directly westward, he lost all sight of land. During the voyage the admiral took care to conceal from his companions the true distance traversed each day; he made it appear less than it really was in the daily abstracts of his observations, that he might not add to the fear already felt by the sailors, by letting them know the real distance which separated them from Europe. Each day he watched the compasses with attention, and it is to him we owe the discovery of the magnetic variation, of which he took account in his calculations. The pilots, however, were much disturbed on seeing the compasses all "northwesters," as they expressed it.

On the 14th of September the sailors saw a swallow and some tropic-birds. The sight of these birds was an evidence of land being near, for they do not usually fly more than about seventy miles out to sea. The temperature was very mild, the weather magnificent; the wind blew from the east and wafted the caravels in the desired direction. But it was exactly this continuance of east wind which frightened the greater part of the sailors, who saw in this persistence, so favorable for the outward voyage, the promise of a formidable obstacle to their return home. On the 16th of September, some tufts of sea-weed, still fresh, were seen floating on the waves. But no land was to be seen, and this sea-weed might possibly indicate the presence of submarine rocks, and not of the shores of a continent. On the 17th, thirty-five days after the departure of the expedition, floating weeds were frequently seen, and upon one mass of weed was found a live crayfish, a sure sign this of the proximity of land.

During the following days a large number of birds, such as gannets, sea-swallows, and tropic-birds, flew around the caravels. Columbus turned their presence to account as a means of reassuring his companions, who were beginning to be terribly frightened at not meeting with land after six weeks of sailing. His own confidence never abated, but putting firm trust in God, he often addressed energetic words of comfort to those around him, and made them each evening chant the Salve Regina, or some other hymn to the Virgin. At the words of this heroic man, so noble, so sure of himself, so superior to all human weaknesses, the courage of the sailors revived, and they again went onward.

We can well imagine how anxiously both officers and men scanned the western horizon toward which they were steering. Each one had a pecuniary motive for wishing to be the first to descry the new Continent, King Ferdinand having promised a reward of 10,000 maravedis, or two thousand dollars, to the first discoverer. The latter days of the month of September were enlivened by the presence of numerous large birds, flying in couples, a sign

that they were not far away from home. So Columbus retained his unshaken conviction that land could not be far off.

On the 1st of October, the admiral announced to his companions that they had made 1,272 miles to the west since leaving Ferro; in reality, the distance traversed exceeded 2,100 miles, and of this Columbus was quite aware, but persisted in his policy of disguising the truth in this particular. On the 7th of October, the crews were excited by hearing discharges of musketry from the "Niña," the commanders of which, the two brothers Pinzon, thought they had descried land; they soon found, however, that they had been mistaken. Still, on their representing that they had seen some parroquets flying in a southwesterly direction, the admiral consented to change his route so far as to steer some points to the south, a change which had happy consequences in the future, for had they continued to run directly westward, the caravels would have been aground upon the great Bahama Bank, and would probably have been altogether destroyed.

Still the ardently desired land did not appear. Each evening the sun as it went down dipped behind an interminable horizon of water. The crews, who had several times been the victims of an optical delusion, now began to murmur against Columbus, "the Genoese, the foreigner," who had enticed them so far away from their country. Some symptoms of mutiny had already shown themselves on board the vessels, when, on the 10th of October, the sailors openly declared that they would go no farther.

On the 11th of October, the admiral noticed alongside of his vessel, a reed still green, floating upon the top of a large wave; at the same time the crew of the "Pinta" hoisted on board another reed, a small board, and a little stick, which appeared to have been cut with an instrument of iron; it was evident that human hands had been employed upon these things. Almost at the same moment, the men of the "Niña" perceived a branch of some

thorny tree covered with blossoms. At all this every one rejoiced exceedingly; there could be no doubt now of the proximity of the coast. Night fell over the sea. The "Pinta," the best sailor of the three vessels, was leading. Already, Columbus himself, and one Rodrigo Sanchez, comptroller of the expedition, had thought they had seen a light moving amidst the shadows of the horizon, when a sailor named Rodrigo on board the "Pinta," cried out, "Land, land."

It was at two o'clock in the morning that the land was first seen, when the caravels were not two hours' sail away from it. At once all the crews, deeply moved, joined in singing together the Salve Regina. With the first rays of the sun they saw a little island, six miles to windward of them. It was one of the Bahama group; Columbus named it San Salvador, and immediately falling on his knees, he began to repeat the hymn of Saint Ambrose and Saint Augustine: "Te Deum Laudamus, Te Dominum confitemur."

At this moment, some naked savages appeared upon the newly discovered coast. Columbus had his long-boat lowered, and got into it with Alonzo and Yanez Pinzon, the comptroller Rodrigo, the secretary Descovedo, and some others. He landed upon the shore, carrying in his hand the royal banner, while the two captains bore between them the green banner of the Cross, upon which were interlaced the initials of Ferdinand and Isabella. Then the admiral solemnly took possession of the island in the name of the King and Queen of Spain, and caused a record of the act to be drawn up. During this ceremony the natives came round Columbus and his companions. Columbus gives the following account of the scene: "Desiring to inspire them (the natives) with friendship for us, and being persuaded, on seeing them, that they would confide the more readily in us, and be the better disposed toward embracing our Holy Faith, if we used mildness in persuading them, rather than if we had recourse to force, I caused to be given to several among them, colored caps, and also glass beads, which

they put around their necks. I added various other articles of small value; they testified great joy, and showed so much gratitude that we marveled greatly at it. When we were re-embarking, they swam towards us, to offer us parroquets, balls of cotton thread, zagayes (or long darts), and many other things; in exchange we gave them some small glass beads, little bells, and other objects. They gave us all they had, but they appeared to me to be very poor. The men and women both were as naked as when they were born. Among those whom we saw, one woman was rather young, and none of the men appeared to be more than thirty years of age. They were well made, their figures handsome, and their faces agreeable. Their hair, as coarse as that of a horse's tail, hung down in front as low as their eyebrows; behind it formed a long mass, which they never cut. There are some who paint themselves with a blackish pigment; their natural color being neither black nor white, but similar to that of the inhabitants of the Canary Islands; some paint themselves with white, some with red, or any other color, either covering the whole body with it, or the whole face, or perhaps only the eyes, or the nose. They do not carry arms like our people, and do not know what they are. When I showed them some swords, they laid hold of them by the blades, and cut their fingers. They have no iron; their zagayes are sticks, the tip is not of iron, but sometimes made of a fish tooth, or of some other hard substance. They have much grace in their movements. I remarked that several had scars upon their bodies, and I asked them, by means of signs, how they had been wounded. They answered in the same manner, that the inhabitants of the neighboring islands had come to attack them, and make them prisoners, and that they had defended themselves. I thought then, and I still think, that they must have come from the mainland to make them prisoners for slaves; they would be faithful and gentle servants. They seem to have the power of repeating quickly what they hear. I am persuaded that they might be converted to Christianity without difficulty, for I believe they belong to no sect."

When Columbus returned on board, several of the savages swam after his boat; the next day, the 13th, they came in crowds around the ships, on board of enormous canoes shaped out of the trunks of trees; they were guided by means of a kind of baker's shovel, and some of the canoes were capable of holding forty men. Several natives wore little plates of gold hanging from their nostrils; they appeared much surprised at the arrival of the strangers, and quite believed that these white men must have fallen from the skies. It was with a mixture of respect and curiosity that they touched the garments of the Spaniards, considering them, doubtless, a kind of natural plumage. The scarlet coat of the admiral excited their admiration above everything, and it was evident that they looked upon Columbus as a parroquet of a superior species; at once they seemed to recognize him as the chief among the strangers.

So Columbus and his followers visited this new island of San Salvador. They were never tired of admiring the beauty of its situation, its magnificent groves, its running streams, and verdant meadows. The fauna of the island offered little variety; parroquets of radiant plumage abounded among the trees, but they appeared to be the only species of birds upon the island. San Salvador presented an almost flat plateau of which no mountain broke the uniformity; a small lake occupied the center of the island. The explorers imagined that San Salvador must contain great mineral riches, since the inhabitants were adorned with ornaments of gold. But was this precious metal derived from the island itself? Upon this point the admiral questioned the natives, and succeeded in learning from them, by means of signs, that in turning the island and sailing toward the south, the admiral would find a country of which the king possessed great vessels of gold and immense riches. The next morning, at daybreak, Columbus gave orders to have the ships prepared for sea; he set sail, and steered toward the continent of which the natives had spoken, which, as he imagined, could be none other than Cipango.

Here an important observation must be made, showing the state of geographical knowledge at this period: viz., that Columbus now believed himself to have arrived at Asia; Cipango being the name given by Marco Polo to Japan. This error of the admiral, shared in by all his companions, was not rectified until many years afterward, and thus, as we have already remarked, the great navigator after four successive voyages to the islands, died, without knowing that he had discovered a new world. It is beyond doubt that the sailors of Columbus, and Columbus himself, imagined that they had arrived during the night of the 12th of October, 1492, either at Japan, or China, or the Indies. This is the reason why America so long bore the name of the "Western Indies," and why the aborigines of this continent, in Brazil and in Mexico, as well as in the United States, are still classed under the general appellation of "Indians." . . .

At last, on the 4th of March, the pilots sighted the mouth of the Tagus, in which the "Niña" took refuge, while the "Pinta," caught by the wind, was carried away into the Bay of Biscay.

The Portuguese welcomed the admiral kindly, the king even admitting him to an audience. Columbus was in haste to return to Spain; as soon as the weather permitted, the "Niña" again set sail and at mid-day on the 15th of March, she cast anchor in the port of Palos, after seven months and a half of navigation, during which Columbus had discovered the islands of San Salvador, Conception, Great Exuma, Long Island, the Mucaras, Cuba, and San Domingo.

The court of Ferdinand and Isabella was then at Barcelona, whither the admiral was summoned. He set out immediately, taking with him the Indians whom he had brought from the New World. The enthusiasm he excited was extreme; from all parts the people ran to look at him as he passed, rendering him royal honors. His entry into Barcelona was magnificent. The king and queen, with all the grandees of Spain, received him with

great pomp at the palace of the Deputation. He there gave an account of his wonderful voyage, and presented the specimens of gold which he had brought with him; then all the assembly knelt down and chanted the Te Deum. Christopher Columbus was afterwards ennobled by letters patent, and the king granted him a coat of arms bearing this device: "To Castile and Leon, Columbus gives a New World." The fame of the Genoese navigator rang through the whole of Europe; the Indians whom he brought with him were baptized in presence of the whole court; and, the man of genius, so long poor and unknown, had now risen to the highest point of celebrity.

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## THE DISCOVERY OF CUBA.

BY

MATURIN M. BALLOU.

Maturin M. Ballou was the son of Hosea Ballou the younger, and came of a distinguished line of Universalist clergymen. He was born in 1820 and died in 1895. For several years he edited the Boston Daily Globe. He was the author of "Due West," "Due South," "The New El Dorado," etc.

COLUMBUS first named Cuba "Juana," in honor of Prince John, son of Ferdinand and Isabella. Subsequently the king named it Fernandina. This was changed to Santiago, and finally to Ave Maria; but the aboriginal designation has never been lost, Cuba being its Indian and only recognized name. The newcomers found the land inhabited by a most peculiar race, hospitable, inoffensive, timid, fond of the dance and the rude music of their own people, yet naturally indolent, from the character of the climate they inhabited. They had some definite idea of God and heaven, and were governed by patriarchs or kings, whose word was their only law, and whose age gave them undisputed precedence. They

From "Due South, or Cuba, Past and Present." Copyright by Maturin M. Ballou. By permission.

spoke the dialect of the Lucayos, or Bahamas, from which islands it is presumed by historians they originated; but it would seem more reasonable to suppose that both the people of the Bahamas and of the West India isles came originally from the mainland; that is, either north or south of the Isthmus of Panama. In numbers they were vaguely estimated at a million, a calculation the correctness of which we cannot but doubt. Reliable local authority, Cubans who have made a study of the early history of the island, assured the author that the aborigines at the time of Velasquez's first settlement, say in 1512, could not have exceeded four hundred thousand. They had but few weapons of offense or defense, and knew not the use of the bow and arrow. Being a peaceful race and having no wild animals to contend with, their ingenuity had never been taxed to invent weapons of warfare against man or beast. The natives were at once subjected by the newcomers, who reduced them gradually to an actual state of slavery, and proving hard task-masters, the poor overworked creatures died by hundreds, until they had nearly disappeared. The home government then granted permission to import negroes from the coast of Africa to labor upon the soil and seek for gold, which was known to exist in the river courses. Thus commenced the foreign slave-trade of the West Indies, King Ferdinand himself sending fifty slaves from Seville to labor in the mines, and until a recent period this plague spot upon humanity festered on the island. It should be remembered in this connection that previous to the discoveries of Columbus, negro slavery had been reduced to a system by the Moors, and thus existed in Spain before the days of the great Genoese.

The Spaniards were not content with putting the aborigines to labor far beyond their power of endurance on the soil where they were born, but shipped them by hundreds to Spain to be sold in the slave-market of Seville, the proceeds being turned into the royal treasury. Columbus himself was the promoter of this outrageous return for the hospitality he had received at the hands of

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A STREET SCENE IN CUBA

FROM A PHOTOGRAPH

The vegetation and architecture alike indicate here tropical conditions. More curious still is the remarkable large, heavy carriage with two wheels which is called in that country a "volante." The driver it will be noticed rides postilion, and it is not difficult to understand that the name of the carriage and its driver comes from the root verb which means to fly, for such a carriage should be capable of being driven at a very high rate of speed.

the natives. Irving apologetically says he was induced to this course in order to indemnify the sovereigns of Castile and Leon for the large expense his expedition had been to them. The fact that the great navigator originated the slave-trade in the New World cannot be ignored, though it detracts in no small degree from the glory of his career.

Although the conquerors have left us but few details respecting these aborigines, still we know with certainty from the narrative of Columbus, and those of some of his most intelligent followers, that they were docile, artless, generous, but inclined to ease; that they were well-formed, grave, and far from possessing the vivacity of the natives of the south of Europe. They expressed themselves with a certain modesty and respect, and were hospitable to the last degree. Reading between the lines of the records of history, it is manifest that after their own rules and estimates, their lives were chaste and proper, though it was admissible for kings to have several wives. Moreover, . . . they religiously observed the decencies of life, and were more outraged by Spanish wickedness than can be clearly expressed. This . . . together with the greed for gold exhibited by the new-comers, disabused the minds of the natives as to the celestial origin of their visitors, a belief which they at first entertained, and which the Spaniards for mercenary purposes strove to impress upon them. The labor of this people was limited to the light work necessary to provide for the prime wants of life, beyond which they knew nothing, while the bounteous climate of the tropics spared the necessity of clothing. They preferred hunting and fishing to agriculture; beans and maize, with the fruits that nature gave them in abundance, rendered their diet at once simple, nutritious, and entirely adequate to all their wants. They possessed no quadrupeds of any description, except a race of voiceless dogs, as they were designated by the early writers—why we know not, since they bear no resemblance to the canine species, but are not very unlike a large rat. This animal

is trapped and eaten by the people on the island to this day, having much of the flavor and nature of the rabbit.

The native Cubans were of tawny complexion and beardless, resembling in many respects the aborigines of North America, and as Columbus described them in his first communication to his royal patrons, were "loving, tractable and peaceable; though entirely naked, their manners were decorous and praiseworthy." The wonderful fecundity of the soil, its range of noble mountains, its widespread and well-watered plains, with its extended coast line and excellent harbors, all challenged the admiration of the discoverers, so that Columbus recorded in his journal these words: "It is the most beautiful island that eyes ever beheld—full of excellent ports and profound rivers." And again he says: "It excels all other countries, as far as the day surpasses the night in brightness and splendor." The spot where the Spaniards first landed is supposed to be on the east coast, just west of Nuevitas. "As he approached the island," says Irving, "he was struck with its magnitude and the grandeur of its features: its airy mountains, which reminded him of Sicily; its fertile valleys and long sweeping plains, watered by noble rivers; its stately forests; its bold promontories and stretching headlands, which melted away into remotest distance."

Excursions inland corroborated the favorable impression made by the country bordering upon the coast. The abundance of yams, Indian corn, and various fruits, together with the plentifulness of wild cotton, impressed the explorers most favorably. Their avarice and greed were also stimulated by the belief that gold was to be found in large quantities, having received enough to convince them of its actual presence in the soil, but in the supposition that the precious metal was to be found in what is termed paying quantities they were mistaken.

The Spaniards were not a little surprised to see the natives using rude pipes, in which they smoked a certain dried leaf with apparent gratification. Tobacco was indigenous, and in the use of this now universal narcotic.

these simple savages indulged in at least one luxury. The flora was strongly individualized. The frangipani, tall and almost leafless, with thick fleshy shoots, decked with a small white blossom, was very fragrant and abundant; here also was the wild passion flower, in which the Spaniards thought they beheld the emblems of our Saviour's passion. The golden-hued peta was found beside the myriad--flowering oleander, while the undergrowth was braided with cacti and aloes. The poisonous manchineel was observed, a drop of whose milky juice will burn the flesh like vitriol. Here the invaders also observed and noted the night-blooming cereus. They were delighted by fruits of which they knew not the names, such as the custard-apple, mango, zapota, banana, and others, growing in such rank luxuriance as to seem miraculous. We can well conceive of the pleasure and surprise of these adventurous strangers, when first partaking of these new and delicate products. This was four hundred years ago, and to-day the same flora and the same luscious food grow there in similar abundance. Nature in this land of ceaseless summer puts forth strange eagerness, ever running to fruits, flowers, and fragrance, as if they were outlets for her exuberant fecundity.

The inoffensive, unsuspicious natives shared freely everything they possessed with the invaders. Hospitality was with them an instinct, fostered by nature all about them; besides which it was a considerable time before they ceased to believe their guests superior beings descended from the clouds in the winged vessels. The Indians lived in villages of two or three hundred houses, built of wood and palm-leaf, each dwelling containing several families, the whole of one lineage, and all were governed by caciques or kings, the spirit of the government being patriarchal.

We are told by Las Casas, who accompanied Velasquez in all his expeditions, that "their dances were graceful and their singing melodious, while with primeval innocence they thought no harm of being clad only with nature's covering." The description of the gorgeous hos-

pitality extended to these treacherous invaders is absolutely touching in the light of our subsequent knowledge. They reared no sacred temples, nor did they seem to worship idols, and yet some few antiquities have been preserved which would seem to indicate that the natives possessed grotesque images, half human and half animal, like Chinese gods in effect. These were wrought so rudely out of stone as hardly to convey any fixed idea; vague and imperfect, it is not safe to define them as idolatrous images. They might have been left here by a previous race, for, as we are all aware, respectable authorities hold that this part of the world was originally peopled by Carthaginians, Israelites, Egyptians, Hindoos, and Africans. Columbus, in his second voyage to the West Indies, found the stern-post of a vessel lying on the shore of one of the Leeward isles, which was strongly presumptive evidence that a European ship had been in these waters before him. The fact that at the time of this writing, there still lies in the harbor of Santiago the wreck of the old St. Paul, which must be over three centuries old, shows how long a piece of marine architecture may last, submerged in salt water.

An idol similar to those referred to was dug up in Hayti, and is now believed to be in the British Museum, drawings of which the author has seen, and which resemble original religious emblems examined by him in the caves of Elephanta, at Bombay. This emblem, carved by a people unacquainted with the use of edge tools, is believed by antiquarians to afford a degree of light as to the history of worship of the ancient inhabitants of Hispaniola, and also to form a collateral support of the conjecture that they sprang from the parent stock of Asia. According to Las Casas, the native Cubans had a vague tradition of the formation of the earth, and of all created things; of the deluge, of the ark, the raven, and the dove. They knew the tradition of Noah also, according to the same high authority, but for our own part we do not believe that the aborigines had any knowledge of this Biblical history. Their priests were fanatics and kept the

people in fear by gross and extravagant means; but as to any formulated system of religious worship, it may be doubted if the aborigines of Cuba recognized any at the time of its discovery by Columbus.

Unbroken peace reigned among them, and they turned their hands against no other people.

These aborigines evinced many of the traits universally evinced by the savage races, such as painting their bodies with red earth and adorning their heads with the feathers of brilliant birds. Much of the soil is red, almost equal to a pigment, for which purpose it was employed by the natives. They lived mostly in the open air, weaving themselves hammocks in which they slept, suspended among the trees. The cotton which they spun grew wild, but tobacco they planted and cultivated after a rude fashion. The iguana and the voiceless dog, already spoken of, were hunted and eaten, the former of the lizard family, the latter scarcely more than fifteen inches long. They had domestic birds which they fattened and ate. Their only arms were lances tipped with sea-shells, and a sort of wooden sword, both of which were more for display than for use. Fish they caught in nets and also with hooks made of bones. Their boats, or canoes, were formed of the dug-out trunks of trees, and some of these canoes, as Columbus tells us, were sufficiently large to accommodate fifty men. An ancient writer upon this subject says the oars were well formed and properly fitted, but were used only with the power of the arms, that is as paddles, no rowlocks being cut in the boat. The speed attained by them was remarkable, reaching four leagues an hour when an effort to that end was made by the occupants. A large canoe, made from the straight trunk of a mahogany tree, is described as having been five feet in width and seventy-five feet long. This craft was propelled by twenty-five oarsmen on each side, a steersman in the stern and a lookout at the prow. This was a cacique's barge, in which he made visits of state along shore and up the rivers.

History has preserved a remarkable and characteristic speech made by a venerable cacique, who approached Co-

lumbus with great reverence on the occasion of his second visit to Cuba, and who, after presenting him with a basket of ripe fruit, said: "Whether you are divinities or mortal men, we know not. You have come into these countries with a force, against which, were we inclined to resist, it would be folly. We are all therefore at your mercy; but if you are men, subject to mortality like ourselves, you cannot be unapprised that after this life there is another, wherein a very different portion is allotted to good and bad men. If therefore you expect to die, and believe, with us, that every one is to be rewarded in a future state according to his conduct in the present, you will do no hurt to those who do none to you." This was duly interpreted to Columbus by a native whom he had taken to Spain, and who had there acquired the Spanish language. His name was Didacus, and the date of the speech was July 7, 1494. The truth of this version is attested by Herrera and others.

The reception which Bartholomew Columbus, who was appointed Deputy Governor in the absence of the Admiral, afterwards met with in his progress through the island to collect tribute from the several caciques manifested not only kindness and submission, but also munificence. Having heard of the eagerness of the strangers for gold, such of them as possessed any brought it forth and freely bestowed it upon the Spaniards. Those who had not gold brought abundance of cotton. One cacique in the interior, named Behechio, invited the Deputy Governor to a state entertainment, on which occasion he was received with great ceremony. As he approached the king's dwelling, the royal wives, thirty in number, carrying branches of palms in their hands, came forth to greet the guest with song and dance. These matrons were succeeded by a train of virgins. The first wore aprons of cotton, the last were arrayed only in the innocence of their nature, their hair flowing long and freely about their shoulders and necks. Their limbs were finely proportioned, and their complexions, though brown, were smooth, shining and lovely. The Spaniards were struck

with admiration, believing that they beheld the dryads of the woods and the nymphs of the ancient fables. The branches which they bore were delivered to the strangers with a low obeisance, indicating entire submission. When the Spaniards entered the rural palace, amid songs and the rude music of the people, they found there a plentiful and, according to the Indian mode of living, a sumptuous banquet prepared for them.

After the repast the guests were each conducted to separate lodgings, and each provided with a cotton hammock. On the next day feasting and games were resumed; dancing and singing closed each evening for four consecutive days, and when the Deputy Governor and his people departed, they were laden with gifts by their generous entertainers, who also accompanied them far on their way. This episode will perhaps serve better to give us a just insight into the condition and character of the aborigines of Cuba at that early period than any amount of detailed description possibly could.

These aborigines, according to Las Casas, had no tradition even, touching their own origin, and when asked about it only shook their heads and pointed to the sky. Antiquarians have endeavored to draw some reliable or at least reasonable deductions from the collections of bones and skeletons found in the mountain caves of the island, but no conclusion worthy of record has ever been arrived at. Still, upon these evidences some scientists pin their faith that Cuba was a portion of the primitive world. Speaking of these caves, there are many subterranean openings on the island, down which rivers of considerable size abruptly disappear, not again to be met with, though it is reasonably presumed that they find their way through the rocks and soil to the sea-coast.

During the ten years subsequent to its discovery, Columbus visited and partially explored the island at four different times, the last being in 1502, four years previous to his death, which took place at Valladolid in 1506. It seems singular to us that his investigations left him still ignorant of the fact that Cuba was an island, and not a

part of a new continent. This conviction remained with him during his lifetime. It was not until 1511 that the Spaniards commenced to colonize the island, when Diego Columbus, then Governor of San Domingo, sent an expedition of three hundred men for the purpose, under the command of Diego Velasquez, whose landing was disputed by the natives. A period of ten years had served to open their eyes to Spanish lust and love of gold, and from having at first regarded them as superior beings, entitled to their obedience, they were finally thus driven to fight them in self-defense. But what could naked savages, armed only with clubs and spears, accomplish against Europeans, trained soldiers, furnished with firearms, protected by plate armor, and accompanied by bloodhounds—men who had learned the art of war by fighting successfully with the valiant Moors? The natives were at once overpowered and hundreds were slaughtered. From that time forth they became the slaves of their conquerors; a fact which reconciles us in some degree in the light of poetical justice to the fact that Amerigo Vespucci, who followed in the footsteps of others, yet took the honors of discovery so far as to give his name to the largest quarter of the globe.

# FIRST SIGHT OF THE ROCKY MOUNTAINS.

BY

SIR WILLIAM FRANCIS BUTLER.

Major-General Sir W. F. Butler, K. C. B., served with distinction on the Red River expedition, and acted as special commissioner to the Saskatchewan Territories in 1870 and 1871. While in command of the West African native forces during the Ashantee war, he was honorably mentioned in several dispatches of Sir Garnet Wolseley. In 1874 he received the order of Companion of the Bath. In 1877 he married Miss Elizabeth Thompson, the famous painter of "The Roll Call," etc. He also served in the Zulu war, and the Egyptian campaigns of 1882, 1884–1885.

While in North America he collected materials for his two well-known works, "The Great Lone Land" and "The Wild North Land." He has written several other books of travel.

IT was near sunset when we rode by the lonely shores of the Gull Lake, whose frozen surface stretched beyond the horizon to the north. Before us, at a distance of some ten miles, lay the abrupt line of the Three Medicine Hills, from whose gorges the first view of the great range of the Rocky Mountains was destined to burst upon my sight. But not on this day was I to behold that long-looked-for vision. Night came quickly down upon the silent wilderness; and it was long after dark when we made our camps by the bank of the Pas-co-pee, or Blindman's River, and turned adrift the weary horses to graze in a well-grassed meadow lying in one of the curves of the river. We had ridden more than sixty miles that day.

About midnight a heavy storm of snow burst upon us, and daybreak revealed the whole camp buried deep in snow. As I threw back the blankets from my head (one always lies covered up completely), the wet, cold mass struck chillily upon my face. The snow was wet and sticky, and therefore things were much more wretched than if the temperature had been lower; but the hot tea

From "The Great Lone Land."

made matters seem brighter, and about breakfast-time the snow ceased to fall, and the clouds began to clear away. Packing our wet blankets together, we set out for the Three Medicine Hills, through whose defiles our course lay; the snow was deep in the narrow valleys, making traveling slower and more laborious than before. It was mid-day when, having rounded the highest of the three hills, we entered a narrow gorge fringed with a fire-ravaged forest. This gorge wound through the hills, preventing a far-reaching view ahead; but at length its western termination was reached, and there lay before me a sight to be long remembered.

The great chain of the Rocky Mountains rose their snow-clad sierras in endless succession. Climbing one of the eminences, I gained a vantage-point on the summit from which some bygone fire had swept the trees. Then, looking west, I beheld the great range in unclouded glory. The snow had cleared the atmosphere, the sky was coldly bright. An immense plain stretched from my feet to the mountain—a plain so vast that every object of hill and wood and lake lay dwarfed into one continuous level, and at the back of this level, beyond the pines and the lakes and the river-courses, rose the giant range, solid, impassable, silent—a mighty barrier rising midst an immense land, standing sentinel over the plains and prairies of America, over the measureless solitudes of this Great Lone Land. Here at last lay the Rocky Mountains.

Leaving behind the Medicine Hills, we descended into the plain and held our way until sunset toward the west. It was a calm and beautiful evening; far-away objects stood out sharp and distinct in the pure atmosphere of these elevated regions. For some hours we had lost sight of the mountains, but shortly before sunset the summit of a long ridge was gained, and they burst suddenly into view in greater magnificence than at mid-day. Telling my men to go on and make the camp at the Medicine river, I rode through some firewasted forest to a lofty grass-covered height which the declining sun was bathing in floods of glory.

PIKE'S PEAK RAILWAY

Lieut. Zebulon M. Pike was sent in 1805 to notify the Louisiana purchase to all the people in that section. Here he discovered, but did not ascend, the famous peak in the Rockies, nearly 15,000 feet high, which bears his name. Its summit was first reached in 1858 by G. F. Ruxton. Now a railroad reaches it—as shown.

I cannot hope to put into the compass of words the scene which lay rolled beneath from this sunset-lighted eminence; for as I looked over the immense plain and watched the slow descent of the evening sun upon the frosted crest of these lone mountains, it seemed as if the varied scenes of my long journey had woven themselves into the landscape, filling with the music of memory the earth, the sky, and the mighty panorama of mountains. Here at length lay the barrier to my onward wanderings, here lay the bound to that 4,000 miles of unceasing travel which had carried me by so many varied scenes so far into the lone lands; and other thoughts were not wanting. The peaks on which I gazed were no pigmies; they stood the culminating monarchs of the mighty range of the Rocky mountains. From the estuary of the Mackenzie to the Lake of Mexico no point of the American continent reaches higher to the skies. That eternal crust of snow seeks in summer widely severed oceans.

The Mackenzie, the Columbia, and the Saskatchewan spring from the peaks whose teeth-like summits lie grouped from this spot into the compass of a single glance. The clouds that cast their moisture upon this long line of upheaven rocks seek again the ocean which gave them birth in its far-separated divisions of Atlantic, Pacific, and Arctic. The sun sank slowly behind the range, and darkness began to fall on the immense plain, but aloft on the topmost edge the pure white of the jagged crest-line glowed for an instant in many colored silver, and then the lonely peaks grew dark and dim.

As thus I watched from the silent hill-top this great mountain-chain, whose summits slept in the glory of the sunset, it seemed no stretch of fancy which made the red man place his paradise beyond their golden peaks. The "Mountains of the Setting Sun," the "Bridge of the World," thus he has named them, and beyond them the soul first catches a glimpse of that mystical land where the tents are pitched midst everlasting verdure and countless herds and the music of ceaseless streams.

# TOLTEC GORGE.

BY

ERNEST INGERSOLL.

Ernest Ingersoll was born in Michigan in 1852 and spent his youth and early manhood in studying natural history in Oberlin College and Harvard University. Besides his many works on this subject he has written several capital stories for young folks which are great favorites with them.

Toltec Gorge is one of the many marvels of the Rocky mountains region; on the border line of Colorado and New Mexico it is between Antonito in the former and Chama in the latter. The whole country abounds in Natural wonders to which human tongue or pen ever fail to do complete justice. A very vivid impression of one of them is however conveyed by the following eloquent description; —

I'll look no more;
Lest my brain turn, and the deficient sight
Topple down headlong. — KING LEAR.

HAVING at last turned our heels reluctantly on the simple-hearted, prettily-checkered life of the Pueblos, we raced back in a single night to the plains of San Luis. A long line of telegraph poles stretches out from Antonio into a true vanishing point across the park, and the train follows it San Juanward. The noble Sangre de Cristo looms up higher and higher behind us as we proceed, a mirage lifting the line of cottonwoods along the Rio Grande into impossibly tall and spindling caricatures of trees; while the Jemez mountains away to the south are not yet lost to view, and the striking landmark of Mount San Antonio, smooth and round, is close at hand. A few miles beyond it the arid level of the lake-spread plain breaks into white, stony eminences, reared in a bold front. To surmount these the track is arranged in long, ingenious loops, in one place, known as the "Whiplash," extending into three parallel lines, scarcely a stone's throw apart, but disposed terrace-like on the hillside. On top of the mesa the sage-brush

From "The Crest of the Continent." Copyright by S. K. Hooper. By permission.

disappears, grass, piñons and yellow pines taking its place, and we begin to wind among the long, straight lava ridges at the foot of the divide between the Los Pinos and the Chama, whence the backward view is remarkably fine. The road here is like a goat's path in its vagaries, and wagers are made as to the point of the compass to be aimed at five minutes in advance, or whether the track on the opposite side of the *crevasse* is the one we have just come over, or are now about to pursue.

Describing a number of large curves around constantly deepening depressions, we reached the breast of a mountain, whence we obtained our first glimpse into Los Pinos valley; and it came like a sudden revelation of beauty and grandeur. The approach had been picturesque and gentle in character. Now we found our train clinging to a narrow pathway carved out far up the mountain's side, while great masses of a volcanic conglomerate towered overhead, and the face of the opposing heights broke off into bristling crags. The river sank deeper and deeper into the narrowing vale, and the space beneath us to its banks was excitingly precipitous. We crowded upon the platform, the outer step of which sometimes hung over an abyss that made us shudder, till some friendly bank placed itself between us and the almost unbroken descent. But we learned to enjoy the imminent edge, along which the train crept so cautiously, and begrudged every instant that the landscape was shut out by intervening objects.

To say that the vision here is grand, awe-inspiring, painfully impressive or memorable, falls short of the truth in each case. It is too much to take in at once, and we are glad to pause again for a little brain-rest at a telegraph station, hung almost like a bird's nest among the rocks—to grow used by degrees to the stupendous picture spread before us. We were so high that not only the bottom of the valley, where the silver ribbon of the Los Pinos trailed in and out among the trees, and underneath the headlands, but even the wooded tops of the further rounded hills were below us, and we could count the dim, distant peaks in New Mexico.

Six miles ahead lay the cañon of which we had heard so much—the Toltec Gorge, whose praises could not be overdrawn. Evidently his majesty had entrenched himself in glories beside which any ordinary monarch would lose his magnificence. Was this king of cañons really so great he could afford to risk all rivalry? Here, on the left, what noble martello-tower of native lava is that which stands undizzied on the very brink of the precipice? I should like to roll it off, and watch it cut a swath through that puny forest down there, and dam up the whole stream with its huge breadth. How these passages of spongy rock resound as our engine drags the long train we have again mounted through their lofty portals! How narrow apparently are these curved and smooth embankments that carry us across the ravines, and how spidery look the firmly-braced bridges that span the torrents! All the way the road-bed is heaped up or dug out artificially. It is merely a shelf near the summit. It hugs the wall like a chamois-stalker, creeping stealthily out to the end of and around each projecting spur; it explores every in-bending gulch, boldly strides across the water-channels, and walks undismayed upon the utmost verge, where rough cliffs overhang it, and the gulf sinks away hundreds of feet beneath.

In the most secluded nook of the mountains we come upon Phantom Curve, with its company of isolated rocks, made of stuff so hard as to have stood upright, tall, grotesque, and sunburned, beside the pigmy firs and cowering boulders with which they are surrounded. Miles away you can trace these black pinnacles, like sentinels, midway up the slopes; but here at hand they fill the eye, and in their fantastic resemblance to human shapes and things we know in miniature, seem to us crumbled images of the days when there were giants, and men of Titanic mold set up mementoes of their brawny heroes—

"Achaian statues in a world so rich!"

*Phantoms,* they are called, and the statuesque shadows they cast, moving mysteriously along the white bluffs, as

the sun declines, are uncanny and ghost-like, perhaps; but the brown, rough, grandly grouping monoliths of lava themselves, are no more phantoms than are the pyramids of Sahara, and beside them the Theban monuments of the mighty Rameses would sink into insignificance.

Winding along the slender track, among these solemn forms, we approach the gorge, the vastly seamed and wrinkled face of whose opposite wall confronts us under the frown of an intense shade—unused to the light from all eternity; but on this, the sunny side, a rosy pile, lifts its massive head proudly far above us, its square, fearless forehead—

> "Fronting heaven's splendor,
> Strong and full and clear."

How should we pass it? On the right stood the solid palisade of the Sierras, rising unbroken to the ultimate heights; on the left the gulf, its sides more and more nearly vertical, more and more terrible in their armature of splintered ledges and pike-pointed tree-tops—more often breaking away into perpendicular cliffs, whence we could hurl a pebble, or ourselves, into the mad torrent easily seen but too far below to be heard; and as we drew nearer, the rosy crags rise higher and more distinct across our path. We turn a curve in the track, the cars leaning toward the inside, as if they, too, retreated from the look down into that "vasty deep," and lo! a gateway tunneled through—the barrier is conquered!

The blank of the tunnel gives one time to think. Pictures of the beetling, ebony-pillared cliffs linger in the retina suddenly deprived of the reality, and reproduce the seamed and jagged rocks in fiery similitude upon the darkness. In a twinkling the impression fades, and at the same instant you catch a gleam of advancing light, and dash out into the sunshine—into the sunshine only? Oh, no, out into the air—an awful leap abroad into invisibly bounded space; and you catch your breath, startled beyond self-control!

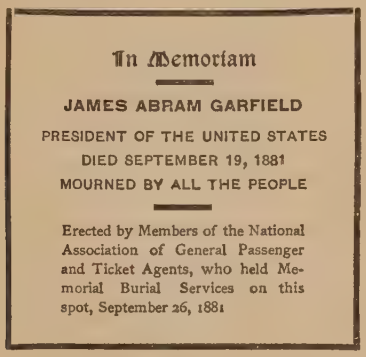
Then it is all over, and you are still on your feet, listening to the familiar ring of the brown walls as they fly past.

What was it you saw that made your breathing cease, and the blood chill in your heart with swift terror? It is hard to remember; but there remains a feeling of an instant's suspension over an irregular chasm that seemed cut to the very center of the earth, and, to your dilated eye, gleamed brightly at the bottom, as though it penetrated even the realms of Pluto. You knew it opened outwardly into the gorge, for there in front stood the mighty wall, bracing the mountain far overhead, and below flashed the foaming river. This is the sum of your recollection, photographed upon your brain by a mental process more instantaneous than any application of art, and never to be erased. Gradually you conclude that the train ran directly out upon a short trestle, one end of which rests in the mouth of the tunnel, and the other in the jaws of a rock cutting. This is the fact; but the traveler reasons it out, for he cannot see the support beneath his car, which, to all intents, takes a flying bound across a cleft in the granite eleven hundred measured feet in depth.

Our train having halted, the artist sought a favorable position for obtaining a sketch of Toltec gorge, the photographer became similarly absorbed, and the remaining members of the expedition zealously examined a spot whose counterpart in rugged and inspiring sublimity probably does not exist elsewhere in America. A few rods up the cañon a thin and ragged pinnacle rises abruptly from the very bottom to a level with the railway track. This point has been christened Eva cliff, and when we had gained its crest by dint of much laborious and hazardous climbing over a narrow gangway of rocks, by which it is barely connected with the neighboring bank, our exertions were well repaid by the splendid view of the gorge it afforded.

Just west of the tunnel, and close beside the track, the rocks have been broken and leveled into a small smooth

space, and here, on the 26th of September, 1881, that gloomiest day in the decade for our people, were celebrated as impressive memorial services for Garfield, the noble man and beloved president, then lying dead on his stately catafalque in Cleveland, as were anywhere seen. The weather itself, in these remote and lonely mountains, seemed in unison with the sadness of the nation, for heavy black clouds swept overhead, and the wind made solemn moanings in the shaken trees. It was under circumstances so fittingly mournful that an excursion party, gathered from nearly every state in the Union, paused to express the universal sorrow, and to conceive the foundation of the massive monument which catches the traveler's eye on the brink of the gorge, and upon whose polished tablet are engraved these words:


In Memoriam
JAMES ABRAM GARFIELD
PRESIDENT OF THE UNITED STATES
DIED SEPTEMBER 19, 1881
MOURNED BY ALL THE PEOPLE
Erected by Members of the National Association of General Passenger and Ticket Agents, who held Memorial Burial Services on this spot, September 26, 1881

# AUDUBON AS TRAVELER AND EXPLORER.

John James Audubon, America's famous Naturalist was born in Louisiana in 1780. A bird-lover from his boyhood, and an artist by nature, his father sent him to Paris to study. On his return he studied his favorite birds in the West and the South, and as a result published his world-famed "Birds of America," containing pictures of more than a thousand birds, life size and in their natural colors.

NOT alone is Audubon entitled to take first rank for his close observation and accurate portrayal of the birds of our country, but as a traveler and an explorer in search of the objects of his study he is worthy of high distinction; and his descriptions of the sights and scenes of nature in all her varied aspects are among the gems of our literature of travel.

The sunshine and the open air, the dense shade of the forest, and the boundless undulations of the prairies, the roar of the sea beating against the rock-ribbed shore, the solitary wilderness of the Upper Arkansas, the Savannahs of the South, the beautiful Ohio, the vast Mississippi, and the green steeps of the Alleghanies—all were as familiar to Audubon as his own home.

In one of his excursions on the Ohio, Audubon was accompanied by his wife and eldest son, then an infant; and they floated on from Pennsylvania to Kentucky, sleeping and living in the boat, under the Indian summer sun and the mellowed beauty of the moon, skirting the delicious shores, so picturesque and lovely at that autumn season, gliding along the stream, and meeting with no other ripple of the water than that formed by the propulsion of the boat. The margins of the river were at that time abundantly supplied with game, and occasionally the party landed at night on the green shore; a few gunshots procured a wild turkey or grouse, or a blue-winged teal; a fire was struck up, and a comfortable repast secured; after which the family again proceeded quietly on their way down stream. The following is only one of the many lovely pictures sketched by Audubon of

UPPER SARANAC LAKE

LAKE CHAMPLAIN.

UPPER SARANAC LAKE AND LAKE CHAMPLAIN

The lakes of the upper part of the State of New York are not only attractive for the lover of Nature, but they contain many places of celebrity and of historic interest.

At the confluence of the outlet of Lake George and Lake Champlain the ruins of the fort of Ticonderoga frown from the summit of a high rocky bluff; the place where Burgoyne held his counsel with the Indian tribes, where Arnold and Carlton fought, where Commodore McDonough gained his victory over the British, and many other points of historic interest are to be found in this region. The whole of this lake system with its mountain region is one of the most attractive health resorts of our country.

this enchanting sail, which probably Longfellow had in his mind's eye when he penned the charming description in his "Evangeline:"

"As night came, sinking in darkness the broader portions of the river, our minds became affected by strong emotions, and wandered far beyond the present moments. The tinkling of the bells told us that the cattle which bore them were gently roving from valley to valley in search of food, or returning to their distant homes. The hooting of the great owl, or the muffled noise of its wings as it sailed smoothly over the stream, were matters of interest to us; so was the sound of the boatman's horn, as it came more and more softly from afar. When daylight returned, many songsters burst forth with echoing notes, more and more mellow to the listening ear. Here and there the lonely cabin of a squatter struck the eye, giving note of commencing civilization. The crossing of the stream by a deer foretold how soon the hills would be covered with snow."

The scene is greatly changed since then. The shores are inhabited; the woods are mainly cleared away; the great herds of elk, deer, and buffalo have ceased to exist; villages, farms, and towns margin the Ohio; hundreds of steamboats are plying up and down the river, by night and by day; and thousands of immigrants have settled down, in all directions, to the pursuits of agriculture and commerce, where once were heard the hoot of the owl, the cry of the whip-poor-will, and the sharp stroke of the squatter's axe.

At another time he takes you into the Great Pine swamp, like a "mass of darkness," the ground overgrown by laurels and pines of all sorts; he has his gun and note-book in hand, and soon you have the wood-thrush, wild turkeys, pheasants, and grouse lying at his feet, with the drawings of which he enriches his portfolio; or you are listening to his host, while he reads by the log fire the glorious poetry of Burns. Again, you are with him on the wild prairie, treading some old Indian track, amid brilliant flowers and long grass, the fawns and their

dams gambolling along his path, and across boundless tracts of rich lands as yet almost untrodden by the foot of the white man, and then only by the Canadian trappers or Indian missionaries. Or he is on the banks of the Mississippi, where the great magnolia shoots up its majestic trunk, crowned with evergreen leaves, and decorated with a thousand beautiful flowers, that perfume the air around; where the forests and fields are adorned with blossoms of every hue; where the golden orange ornaments the gardens and the groves; where the white-flowered Stuartia and innumerable vines festoon the dense foliage of the magnificent woods, shedding on the vernal breeze the perfume of their clustered flowers; there, by the side of deep streams, or under the dense foliage, he watches by night the mocking-bird, the whip-poor-will, the yellow-throat, the hunting-bird, and the thousand beautiful songsters of that delicious land. Then a crevasse, or sudden irruption of the swollen Mississippi, occurs, and forthwith he is floating over the submerged lands of the interior, nature all silent and melancholy, unless when the mournful bleating of the hemmed-in deer reaches the ear, or the dismal scream of an eagle or a raven is heard, as the bird rises from the carcass on which it had been satisfying its appetite.

In the course of his extensive wanderings, Audubon experienced all sorts of adventures. Once he was within an inch of his life in a solitary squatter's hut in one of the wide prairies of the upper Mississippi; in one of the extensive swamps of the Choctaw territory in the State of Mississippi, he joined in the hunt of a ferocious cougar or painter (panther) which had been the destruction of the flocks in that neighborhood; in the barrens of Kentucky he was once surprised by an earthquake, the ground rising and falling under his terrified horse like the ruffled waters of a lake; he became familiar with storms and hurricanes, which only afforded new subjects for his graphic pen; he joined in the Kentucky hunting sports, or with the Indian expeditions on the far prairie; he witnessed the astounding flights of wild pigeons in countless

multitudes, lasting for whole days in succession, so that "the air was literally filled with pigeons, the light of noonday obscured as by an eclipse, and the continued buzzing of the millions of wings had a tendency to lull the senses to repose"—one of these enormous flocks extending, it is estimated by Audubon, over a space of not less than 180 miles; then he is on the trail of the deer or the buffalo in the hunting-grounds of the far West, he misses his way, and lies down for the night in the copse under the clear sky, or takes shelter with a trapper, where he is always welcome; then he is in the Gulf of Mexico, spending weeks together in the pursuit of birds, or observing their haunts and habits; then again he is in the thick of a bear-hunt.

Accompanied by his wife, Audubon left New Orleans in January, 1830, went to New York, and from thence to England, where he arrived to receive a diploma from the Royal Society, which he esteemed as a great honor. Returning home in 1831, he took with him two assistants, his work assuming an importance not before dreamed of. The government now aided him, and he was provided with letters of protection along the frontiers, which proved valuable helps. His chief field of investigation this year was Florida—full of interest and novelty to the ornithologist. It was, comparatively, a new field, and Audubon explored it with his usual enthusiasm. There, along the reef-bound coast about Key West, and among the islets of coral that everywhere rise from the surface of the ocean like gigantic water-lilies, he cruised in his bark, often under a burning sun, pushing for miles over soapy flats, tormented by myriads of insects, but eager to procure some new heron, the possession of which would at once compensate him for all his toils. There, in their native haunts, he studied the habits of the sandpiper and the cormorant, and scoured the billows after the fulmar and the frigate-bird. There, along the shore, among its luxuriant fringe of flowers, plants, and trees, gorgeously luxuriant, he followed after birds nearly all of which were new to him, and which filled him with boundless delight.

On the east coast of Florida, he was surprised and delighted at the wild orange-groves through which his steps often led him; the rich perfume of the blossoms, the golden hue of the fruits that hung on every twig and lay scattered on the ground, and the deep green of the glossy leaves which sometimes half concealed the golden fruit. Audubon used sometimes to pass through orange-groves of this kind a full mile in extent, quenching his thirst with the luscious fruit, and delighted at the rich variety of life with which the woods were filled.

Having received letters from the Secretaries of the Navy and Treasury of the United States to the commanding officers of the vessels of war and of the reserve service, directing them to afford assistance to Audubon in his labors, he on one occasion embarked at St. Augustine, in the schooner "Spark," for St. John's river, a little to the north. He now studied, amid their haunts along the coast, the snowy pelican, cormorants, sea-eagles, and blue herons; and sailed for one hundred miles up the river, between banks swarming with alligators, where he landed and made familiar acquaintance with beautiful hummingbirds, and the other frequenters of the groves and thickets in that tropical region. Here is an ugly phase of the naturalist's life:

"Alligators were extremely abundant, and the heads of the fishes which they had snapped off lay floating around on the dark waters. A rifle-bullet was now and then sent through the eye of one of the largest, which, with a tremendous splash of its tail, expired. One morning we saw a monstrous fellow lying on the shore. I was desirous of obtaining him, to make an accurate drawing of his head, and, accompanied by my assistant and two of the sailors proceeded cautiously toward him. When within a few yards, one of us fired and sent through his side an ounce ball, which tore open a hole large enough to receive a man's hand. He slowly raised his head, bent himself upward, opened his huge jaws, swung his tail to and fro, rose on his legs, blew in a frightful manner, and fell to the earth. My assistant leaped on shore, and, con-

trary to my injunctions, caught hold of the animal's tail; when the alligator, awaking from its trance, with a last effort crawled slowly toward the water, and plunged heavily into it. Had he once thought of flourishing his tremendous weapon, there might have been an end of his assailant's life; but he fortunately went in peace to his grave, where we left him, as the water was deep. The same morning another of equal size was observed swimming directly for the bows of our vessel, attracted by the gentle rippling of the water there. One of the officers, who had watched him, fired and scattered his brains through the air, when he trembled and rolled at a fearful rate, blowing all the while most furiously. The river was bloody for yards round; but although the monster passed close by the vessel, we could not secure him, and after a while he sank to the bottom."

At other times, Audubon was carried out beyond the coral reefs which surround the Floridian coast, to the Keys, or islands standing out a little to sea. These were covered with rich vegetation, and full of life. The shores were also swarming with crabs and shellfish of all kinds. "One of my companions thrust himself into the tangled groves that covered all but the beautiful coral beach that in a continued line bordered the island, while others gazed on the glowing and diversified hues of the curious inhabitants of the deep. I saw one rush into the limpid element to seize on a crab, that, with claws extended upward, awaited his opponent, as if determined not to give way. A loud voice called him back to the land, for sharks are as abundant along those shores as pebbles, and the hungry prowlers could not have got a more dainty dinner."

Flamingoes, ibises, pelicans, cormorants, and herons frequent those islands in vast numbers, and turtles and sea-cows bask along their shores. The party landed at night on the Indian Key, where they were kindly welcomed; and, while the dance and the song were going on around him, Audubon, his head filled with his pursuit, sat sketching the birds that he had seen, and filling up his notes respecting the objects witnessed in the course of the

day. Thus it is that his descriptions have so strong and fresh a flavor of nature, and that to read them is like being present at the scenes he so graphically depicts. After supper, the lights were put out, the captain returned to his vessel, and the ornithologist, with his young men, "slept in light swinging hammocks under the eaves of the piazza." It was the end of April, when the nights are short there and the days long; so, anxious to turn every moment to account, they were all on board again at three o'clock next morning, and proceeded outward to sea. He thus briefly describes a sunrise on one of those early April mornings:

"The gentle sea-breeze glided over the flowing tide, the horizon was clear, and all was silent save the long breakers that rushed over the distant reefs. As we were proceeding toward some keys seldom visited by man, the sun rose from the bosom of the waters with a burst of glory that flashed on my soul the idea of that Power which called into existence so magnificent an object. The moon, thin and pale, as if ashamed to show her feeble light, concealed herself in the dim west. The surface of the waters shone in its tremulous smoothness, and the deep blue of the clear beams was pure as the world that lies beyond them. The heron flew heavily toward the land, like the glutton retiring at daybreak, with well-lined paunch, from the house of some wealthy patron of good cheer. The night-heron and the owl, fearful of day, with hurried flight sought safety in the recesses of the deepest swamps; while the gulls and terns, ever cheerful, gamboled over the waters, exulting in the prospect of abundance. I also exulted in hope; my whole frame seemed to expand; and our sturdy crew showed, by their merry faces, that nature had charms for them too. How much of beauty and joy is lost to those who never view the rising of the sun, and of whose waking existence the best half is nocturnal."

They landed on Sandy island, which lies about six miles from the extreme point of South Florida, stretching away down into the Gulf of Mexico; they laid themselves down in the sand to sleep, the waters almost bathing their feet;

the boat lay at their side, like a whale reposing on a mud-bank. Birds in myriads fed around them — ibises, god-wits, herons, fish-crows, and frigate pelicans. Having explored the island, and shot a number of birds, they proceeded back to land through the tortuous channels among the reefs, and were caught by one of those sudden hurricanes which so often sweep across the seas. And here is Audubon's picture of the storm:

"We were not more than a cable's length from the shore, when, with imperative voice, the pilot said to us: 'Sit quite still, gentlemen, for I should not like to lose you overboard just now; the boat can't upset, my word for that, if you but sit still. Here you have it!' Persons who have never witnessed hurricanes such as not infrequently desolate the sunny climates of the south, can scarcely form an idea of their terrific grandeur. One would think that, not content with laying waste all on land, it must needs sweep the waters of the shallows quite dry to quench its thirst. No respite for an instant does it afford to the objects within the reach of its furious current. Like the scythe of the destroying angel, it cuts everything by the roots, as it were, with the careless ease of the experienced mower. Each of its revolving sweeps collects a heap that might be likened to the full sheaf which the husbandman flings by his side. On it goes, with a wildness and fury that are indescribable; and when at last its frightful blasts have ceased, Nature, weeping and disconsolate, is left bereaved of her beauteous offspring. In some instances even a full century is required before, with all her powerful energies, she can repair her loss. The planter has not only lost his mansion, his crops, and his flocks, but he has to clear his lands anew, covered and entangled as they are with the trunks and branches of trees that are everywhere strewn. The bark, overtaken by the storm, is cast on the leeshore, and, if any are left to witness the fatal results, they are the 'wreckers' alone, who, with inward delight, gaze upon the melancholy spectacle. Our light bark shivered like a leaf the instant the blast reached her sides. We thought she had gone

over, but the next instant she was on the shore. And now, in contemplation of the sublime and awful storm, I gazed around me. The waters drifted like snow, the tough mangroves hid their tops amid their roots, and the loud roaring of the waves driven among them blended with the howl of the tempest. It was not rain that fell; the masses of water flew in a horizontal direction, and when a part of my body was exposed, I felt as if a smart blow had been given to it. But enough! — in half an hour it was over. The pure blue sky once more embellished the heavens, and although it was now quite night, we considered our situation a good one. The crew and some of the party spent the night in the boat. The pilot, myself, and one of my assistants, took to the heart of the mangroves, and having found high land, we made a fire as well as we could, spread a tarpaulin, and, fixing our insect bars over us, soon forgot in sleep the horrors that had surrounded us."

At another time the grand, rocky coasts of Labrador, haunted by innumerable sea-birds, attracted him. At Eastport, in Maine, he chartered a beautiful and fast-sailing schooner, the "Ripley," and set sail, with several friends, on his delightful voyage. He passed out of the port under a salute of honor from the guns of the fort, and of the revenue-cutter at anchor in the bay. Touching islands in the St. Lawrence Gulf, each haunted by its peculiar tribes of birds, a heavy gale came on, and the vessel sped away, under reefed sails, to the coast of Labrador. Masses of drifting ice and snow, filling every nook and cove of the rugged shores, came in sight; they neared the coast at the place called the "American Harbor," and there Audubon landed. The "Ripley" sailed further north, and entered the harbor of Little Macatina, of which this is his description:

"It was the middle of July: the weather was mild, and very pleasant; our vessel made her way, under a smart breeze, through a very narrow passage, beyond which we found ourselves in a small, circular basin of water, having

an extent of seven or eight acres. It was so surrounded by high, abrupt, and rugged rocks, that, as I glanced around, I could find no apter comparison for our situation than that of a nut-shell at the bottom of a basin. The dark shadows that overspread the waters, and the mournful silence of the surrounding desert, sombred our otherwise glad feelings into a state of awe. The scenery was grand and melancholy. On one side hung over our heads, in stupendous masses, a rock several hundred feet high, the fissures of which might to some have looked like the mouths of a huge, undefined monster. Here and there a few dwarf pines were stuck, as if by magic, to this enormous mass of granite; in a gap of the cliff, the brood of a pair of grim ravens shrunk from our sight, and the gulls, one after another, began to wend their way overhead toward the middle of the quiet pool, as the furling of the sails was accompanied by the glad cries of the sailors. The remarkable land-beacons erected in that country to guide vessels into the harbor, looked like so many figures of gigantic stature, formed from the large blocks that lay on every hill around. A low valley, in which meandered a rivulet, opened at a distance to the view. The remains of a deserted camp of seal-catchers was easily traced from our deck, and as easily could we perceive the innate tendency of man to mischief, in the charred and crumbling ruins of the dwarf-pine forests. But the harbor was so safe and commodious, that, before we left it to find shelter in another, we had cause to be thankful for its friendly protection."

In 1836, he again visited the western coast of Florida, and sailed through the Gulf of Mexico to New Orleans; then explored the coast of Texas to the Bay of Galveston, travelled across Texas, and returned again to New Orleans. Crossing the country by Mobile, Pensacola, and Augusta, he again reached Charleston, and thence northward by Washington to New York. He embarked again for England in 1837, where new honors and diplomas awaited him, bringing out his fourth volume of "Ornithological Biography" at the end of 1838. He was now

sixty-three years of age, but, speaking of himself, he observed: "The adventures and vicissitudes which have fallen to my lot, instead of tending to diminish the fervid enthusiasm of my nature, have imparted a toughness to my bodily constitution, naturally strong, and to my mind, naturally buoyant, an elasticity such as to assure me that, though somewhat old, and considerably denuded in the frontal region, I could yet perform on foot a journey of any length, were I sure that I should thereby add materially to our knowledge of the ever-interesting creatures which have for so long a time occupied my thoughts by day, and filled my dreams with pleasant images."

"Amid the tall grass," said he, "of the far-extended prairies of the West, in the solemn gusts of the North, on the heights of the midland mountains, by the shores of the boundless ocean, and on the bosom of the vast lakes and magnificent rivers, have I sought to search out the things which have been hidden since the creation of this wondrous world, or seen only by the naked Indian, who has, for unknown ages, dwelt in the gorgeous but melancholy wilderness. Who is the stranger to my own dear country that can form an adequate conception of its primeval woods — of the glory of those columnar trunks that for centuries have waved in the breeze and resisted the shock of the tempest — of the vast bays of our Atlantic coasts, replenished by thousands of streams, differing in magnitude as differ the stars that sparkle in the expanse of the pure heavens — of the density of aspect in our Western plains, our sandy Southern shores, interspersed with reedy swamps, and the cliffs that protect our Eastern coasts — of the rapid currents of the Mexican Gulf, and the rushing tide-streams of the Bay of Fundy — of our ocean lakes, our mighty rivers, our thundering cataracts, our majestic mountains, rearing their snowy heads into the calmest regions of the clear cold sky? Would that I could delineate the varied features of that loved land!"

## THE THOUSAND ISLANDS

Probably nature presents no greater variety of beautiful scenery than is to be found in the labyrinth of land and water known as the Thousand Islands of the St. Lawrence River, while the names of the places in and around about them are full of historic memories and associations, while to the naturalist it is full of interest, the traveller and explorer will find constantly new delights.

# THE ELDORADO OF THE GREAT WEST OR THE DISCOVERY OF GOLD IN CALIFORNIA.

BY

ARCHIBALD WILLIAMS.

PARALLEL to the coast of Upper California, at a distance inland of about 200 miles, runs the Sierra Nevada, a continuous and lofty range marked by a line of dominant peaks, many of which are over 14,000 feet high. It has an average width of about eighty miles, and its western slopes are more gentle than the eastern, which abound in precipitous declines.

From the mountains many streams hurry westward to join a main river, called the Sacramento, flowing into the San Francisco Bay. On their way these tributaries cut through mighty deposits of gravel, which in the course of the ages have been detached from the heights and distributed along the valleys. From the latitude of San Francisco north to Oregon the strata of the range have received a liberal salting with gold at the hands of Nature; and the water has separated huge quantities of it from its bed, to strew it in the river courses and in gulches through which streams no longer flow.

This huge auriferous belt on the Sierra's western slope is the Eldorado of the West.

One January day in 1848 a Mr. Marshall was making alterations at his saw-mill on the Americanos River, which enters the Sacramento at a point where the town of the same name now rises. The tail-race of the mill being too narrow to allow the water to run off in sufficient quantities to get full work out of the wheel, he threw the mill-wheel out of gear, and suddenly let the whole body of water behind the dam loose into the race. This operation considerably enlarged the narrow channel, and a mass of sand and gravel was carried off by the force of

From "The Romance of Mining." London.

the current. Captain Sutter, a neighbor, thus related what followed to Dr. J. Tyrwhitt Brooks, one of the pioneer miners:[1] "Early in the morning after this took place, he was walking along the left bank of the stream, when he perceived something which he at first took for a piece of opal — a clear transparent stone, very common there — glittering on one of the spots laid bare by the sudden crumbling of the bank. He paid no attention to this: but while he was giving directions to the workmen, having observed several similar glittering fragments, his curiosity was so far excited that he stooped down and picked one of them up. 'Do you know,' said Mr. Marshall to me, 'I positively debated with myself two or three times whether I should take the trouble to bend my back to pick up one of the pieces, and had decided on not doing so, when, further on, another glittering morsel caught my eye — the largest of the pieces now before you. I condescended to pick it up, and to my astonishment found it was a thin scale of what appears to be pure gold.' He then gathered some twenty or thirty similar pieces, which on examination convinced him that his suppositions were right. His first impression was that this gold had been lost or buried there by some early Indian tribe — perhaps some of those mysterious inhabitants of the west, of whom we have no account, but who dwelt on this continent centuries ago, and built those cities and temples, the ruins of which are scattered about these solitary wilds. On proceeding, however, to examine the neighboring soil, he discovered that it was more or less auriferous. This at once decided him. He mounted his horse, and rode down to me as fast as it would carry him with the news."

Captain Sutter was soon convinced by the specimens shown that an epoch in Californian history had been opened. Of course the first thing for the two lucky men to do was to keep the discovery to themselves. They visited the mill and poked about among the sand with such good results that they soon had collected an ounce

[1] "Four Months among the Gold Finders in Alta, California."

of the precious metal. The next day they went further up the stream, and found that gold existed along the whole course, not only in the bed of the main stream, but also in the now dried-up gulches and creeks leading into it. Indeed, gold appeared most plentiful in the ravines, for Captain Sutter picked out of a dry gorge with his knife a lump of solid gold scaling nearly one and a half ounces.

Unfortunately for the discoverer and his friend, the mill workpeople had scented booty. A Kentuckian, suspecting that "something was up," dogged the prospectors' steps, and searched for the object of their wanderings, so that when they returned to the mill they were astonished, not to say disgusted, by the laborers running up with flakes of gold, which an Indian, who had previously worked in a mine in Lower California, had immediately recognized as the "true stuff." The secret had thus become public property in a very few hours.

Such a piece of news soon spread, and hard on its heels came actual proof of its truth in the shape of gold flakes sent down to San Francisco. On May 8 a man entered the town with twenty-three ounces of gold. People at once began with one voice to talk of nothing but the new "placers"—a Spanish term signifying spots where gold is found mixed with alluvial deposits. Parties were formed at once to visit the diggings, and individuals started off alone with shovels, mattocks, and pans to dig the metal out. The talk soon bred a perfect *furore*. All the workpeople struck. Out of fifty new buildings in course of construction only about half-a-dozen were not bereft of artisans; the majority of whom, together with lawyers, storekeepers, and merchants, were bitten by the fever. On many a door could be seen a paper bearing the legend, "Gone to the diggings."

Wages increased by leaps and bounds. The people who remained behind could ask their own terms. Salesmen and shopmen got $2,300 to $2,700 a year, with board; and even boys received salaries which in the pre-mania days would have satisfied the heads of large de-

partments. But while many houses were being deserted, fresh inhabitants poured in by sea, many having come across the Isthmus of Panama to a point where they could take ship. Up sprang a host of canvas booths to accommodate the newcomers. In the better parts of the town stupendous taverns, gambling houses, and other buildings commanded huge rents; anything up to $100,000 a year. "Skirting the beach," writes an eye-witness,[1] "was a vast collection of tents, called the 'Happy Valley'—since more truly designated the 'Sickly Valley'—where filth of every description, and stagnant pools, beset one at every stride. In these tents congregated the refuse of all nations, crowded together; eight people occupying what was only space for two. Blankets, firearms, and cooking utensils were the only worldly property they possessed. Scenes of depravity, sickness, and wretchedness shocked the moral sense, as much as filth and effluvia did the nerves; and such was the state of personal insecurity that few 'citizens' slept without firearms at hand. The constant wearing of arms by such a disorderly set, amongst whom quarrels were frequent, caused many disputes to terminate disastrously; but the unsettled state of the country, and the many desperate characters prowling about, made it necessary to be armed for self-protection—the weaker party was only sheltered from oppression by a loaded revolver, as there was no assistance to be expected from others. Steel and lead were the only arguments available for redress, and bystanders looked on unconcernedly at acts of violence; the cause of the dispute, or the justice of the punishment inflicted, being seldom inquired into."

A poor man arriving in San Francisco had small chance of comfort. Even if he possessed a fairly heavy purse, it soon lost its weight in a city where a good meal cost three dollars, even if the owner kept clear of the many gambling hells which kept open house for the allurement of "greenhorns."

In the 'fifties San Francisco was very inaccessible as

[1] Mr. William Shaw.

compared with its position to-day at the termini of several great transcontinental lines. To get thither from the east coast the traveller had a choice between a tedious sea journey round the Horn; a partly sea and partly land route *via* the Panama Isthmus — across which a road and subsequently a railroad were driven; and a land march of some 3,000 miles. Nevertheless, the distant Sierras soon teemed with a population of many thousands. Most of the immigrants, at least during the first two years, came in from the coast; while a minority worked across the trackless plains, braving the hostility of the Indians and the many physical difficulties of a passage through a waterless, trackless, and arid region. Many a bloody battle was fought between the white gold-seekers and the scalp-loving Crow, Pawnee, or Sioux. Though the lighter color eventually prevailed, the natives, well skilled in the arts of treachery and ambuscade, often murdered parties of their natural foes, and escaped with their gory trophies into the fastnesses of the mountains.

Shortly after the discovery of gold a large emigrant band of Mormons entered California across the Rockies. Without wasting time they made straight for the Americanos River, and began washing out the golden flakes and dust which permeated the bed of the stream. They did not have the valley to themselves for long, since the miners from San Francisco were now on the march to the "Mormon Diggings," as they were called after the first-comers.

The miners leaving San Francisco for the goldfields often banded together for mutual protection and help. The perils of the journey were such as to render the passage of a solitary person a terribly risky business.

Before starting, the more prudent gold-seekers equipped themselves with an outfit, viz.: tent, spades, mattocks, axe, blankets, hides, coffee, sugar, whiskey, brandy, knives, plates, forks, pots and kettles. If funds permitted, a horse or two would be added to the list as beasts of burden, and any one who could afford it purchased a mount for his personal use. . . .

At first operations were confined almost entirely to the shallow or surface diggings, where the gold lay at, or just below, the surface. Not until the superficial stratum was pretty well played out was serious attention paid to the deeper placers, which could be worked only through long tunnels and shafts.

The principal implements used for shallow working are the pick and shovel, pan, cradle or rocker, and the sluice. The pan, about twelve inches in diameter at the bottom, is of stamped iron, and much resembles the ordinary dairy milk-pan. To extract gold from the earth with which it mingles, the pan is filled with the "dirt" and taken into the water — a stream, tub, or pool, as the case may be. It is submerged, and the miner works the dirt with his hands until the lumps have crumbled; then, holding one side of the pan rather higher than the other, he gives it a peculiar circular motion which produces a rotary current and causes the lighter portion to pass over the lip, the heavier particles remaining behind. The earthly element is thus gradually eliminated, and the pebbles are picked out by hand, until only a small residue remains, which is either pure gold, or gold mixed with a small quantity of sand. The residue is then carefully dried in an iron vessel, and the earthy dust can be blown away, leaving nothing but pure gold.

Panning is slow and laborious work, so that those who had money or skill sufficient to provide themselves with a rocker — or "gold canoe," as the Indian styled it — resorted to this less primitive method of washing. The rocker resembles a child's cradle. About six inches from the top is a drawer, with a bottom of perforated iron. Earth is thrown by one man into the drawer and well flooded with water to break up the lumps. A second miner rocks the cradle backwards and forwards till the finer contents of the drawer fall through into the sloping tray below, on which are cross bars, called riffles, to arrest the gold.

Much more scientific than either of these simple contrivances is the "sluice," a long, slightly inclined trough,

through which water flows rapidly. Its dimensions vary according to circumstances. In some cases only a single trough, ten to twelve inches deep, fifteen to twenty wide, and twelve feet long, would be used; but as each trough tapers towards its lower end, any number can easily be fitted one into the other to form a continuous sluice thousands of feet in length. The trough bottom is well provided with riffles, sometimes charged with mercury to catch the particles of gold; the more mercury being needed the finer the separation of the metal dust. Sluice washing is, if possible, carried on without interruption day and night, for weeks, even for months. Then comes the "clean-up." The gold, either "free" or amalgamated with the mercury, is carefully scraped from the riffles and washed clean in a pan. Amalgam has to be squeezed in buckskin or canvas, which allows the liquid mercury to pass, but retains the solid amalgam. This is put into a retort, and subjected to great heat until all the mercury has vaporized and been led into a condenser, where it resumes its liquid form. The gold thus obtained is very porous, or "spongy," and must be melted down and run into bars to be fit for sale.

In '49 and '50 the rocker and pan did most of the work. The toil was severe, in the case of the pan, which required constant stooping, while the constant immersion of the hands rapidly macerated the skin and made them very painful. The rocker saved the hands this injury, and, by employing several sets of muscles, enabled the miner to keep on working without much physical discomfort. By a rule of the diggings, when a party operated a cradle, a nugget weighing over half an ounce was considered to be the private property of the person who found it, and was not added to the common fund of metal.

For five years the "rush" continued. Men poured in from all sides. The terrible trans-continental journey was undertaken by thousands of immigrants who started from St. Louis or Omaha on the Missouri, pushed along the Platte River, crossed the Rockies, encountered the horrors of the Great Salt Lake Desert, and, after a final

struggle with the Sierra Nevada, dropped down into the Land of Promise, their numbers sadly thinned by wounds, accidents, disease, hunger, and thirst. Mark Twain, writing of this route, and the Great Desert in particular, said:[1] "It was a dreary pull, and a long and thirsty one, for we had no water. From one extremity of this desert to the other, the road was white with the bones of oxen and horses. It would hardly be an exaggeration to say that we could have walked the forty miles and set our feet on a bone at every step! The desert was one prodigious graveyard. And the log-chains, waggon-trees, and rotting wrecks of vehicles were almost as thick as the bones. I think we saw log-chains enough rusting there in the desert to reach across any State in the Union. Do not these relics suggest something of an idea of the fearful suffering and privation the early immigrants to California endured?"

It is impossible to say how many miners were actually at work in California at the time of the greatest excitement, but 50,000 is the figure suggested for 1850. In 1852 and 1853 this number had probably doubled; and as the new-comers found the rich deposits of surface gold ready to hand the total output of these years marked the highest level of the Californian output — some 65 million dollars' worth per annum. Memorable among the richest "strikes" of those days are those of the Stanislaus, Americanos, Yuba, and Feather Rivers, where the fortunate owners washed out from *one to five thousand dollars a day!* But such spots as these were very limited in area, like the rich "pockets" found in the mountains, where gold had accumulated most amazingly. One of the pockets yielded $60,000 in two weeks; another just double that amount in three months; while smaller deposits, laid bare in several instances by rooting hogs, panned out $5,000 and upwards.

As soon as the richest bars and gulches had been worked over, a spirit of recklessness affected the miners, who were, as Mark Twain says, "no simpering, dainty,

[1] "Roughing it," Chap. xx.

kid-gloved weaklings, but stalwart, dauntless young braves, brimful of push and energy, and royally endowed with every attribute that goes to make up a peerless and magnificent manhood — the very pick of the world's glorious ones." Mr. Twain is evidently here referring only to the more respectable part of the population, as the immigrants certainly contained a high percentage of thoroughgoing scoundrels, who, if not villains to begin with, rapidly developed into such under the deteriorating influences of gold-mining. Yet in his pages, and in those of Mr. Bret Harte, we are able to detect the kindliness that often concealed itself under a rough and forbidding exterior. The man who was ready to draw his "gun" on little provocation, could also lend a helping hand to a mate in time of need.

These folk, wrought to a pitch of nervous frenzy by the myriad reports flying about, were only too easily induced to leave a locality of moderate wealth, and to plunge into the unknown beyond the mountains. After months of fruitless searching for the advertised "inexhaustible focus of gold," they would return — those who had not succumbed to privation — poverty-stricken and ragged, to find the claims they had left already occupied by fresh arrivals. A great "rush" of this description took place in 1855, to the Kern River, 250 miles south of San Francisco. Three years later 20,000 men picked up their traps and stampeded to the Fraser River, denuding California of a large proportion of her workers. The sufferings of this misguided mob were terrible; their success very moderate.

By 1855 the "shallow placers" had been almost exhausted. The pan and rocker no longer brought out enough gold to render their use profitable. There remained, however, the deeper placers and the "lode" gold, embedded in a quartz matrix. So, while a thousand little mushroom mining cities, deserted by their busy population, crumbled into ruins amid the deathly silence of the valleys, a hundred more rose elsewhere, occupied by men bent on continuing the search with a more scientific equipment, and a different organization of labor.

# THE ELDORADO OF THE NORTH OR THE DISCOVERY OF GOLD IN THE KLONDIKE.

BY

ARCHIBALD WILLIAMS.

ONE July day in 1897 a small steamer, the *Excelsior*, steamed into San Francisco harbor with a cargo that would have shamed many a Spanish galleon of old times. The passengers were miners, their faces scarred by much hardship and privation. About their personal appearance there was beyond this nothing remarkable; but they brought with them, tied up in sacks, skins, old clothes, cans, preserve-pots, and every imaginable article that would hold it, gold dust — precious gold dust and nuggets, a full ton in weight. From that moment millions of tongues began to wag about the marvelous Tom Tiddler's ground in Alaska and Northwest Canada, where gold could be had almost for the trouble of picking it up. So the report ran, and gossip soon bred a fever which caused men of all classes to quit their work and hurry off to secure in the distant goldfields, after a few months' labor, enough wealth to furnish them with a comfortable livelihood for the rest of their lives. The "rushes" to California and the Australian goldfields in the middle of the century were paralleled, even if not surpassed. Physical obstacles could not deter the adventurer — clerk, mechanic, government official, or aristocrat, the thirst for the precious metal blinded his eyes to the coming and well-known terrors of precipitous, snow-clad mountains. Off he went, full of hope, but often miserably supplied with a proper outfit, destined, in many cases, to leave his bones in the passes, or at the bottom of the swirling Yukon. The lucky few made their fortunes in those early years of the boom, but they were the few.

From "The Romance of Mining." London.

Let us glance at the early history of the discovery of the vast gold-bearing gravel regions which cover many thousands of square miles on both banks of the mighty Yukon, a river ranking very high among the great streams of the world in point of both length and volume. For sixteen hundred miles the Yukon is navigable by craft of the size of the largest Mississippi steamers, and for five hundred miles above that by boats of half that size. Rising in the lakes on the north flank of the St. Elias Range, at about the 60th parallel of north latitude, the river makes a huge sweep northwards; at Fort Yukon, 350 miles north, just touches the Arctic Circle; and bends southwards again to its mouth. About 1,600 miles up from the sea is the great gold-scattered tract to which men are hurrying, 300 miles nearer the Pole than St. Petersburg. At midsummer twenty-two out of the twenty-four hours are brightened by the sun, shining down with almost tropical heat. At midwinter darkness claims an equal proportion of the day, and cold lays an icy grip on the country which is not slackened for months. Herein lies the main difference between the early Klondike and the other great goldfields of the world. A man might be lost in California, Africa, or Australia, and yet manage to find his way out. But not so here, "Once in always in," after the winter had commenced; and to lose one's way was to perish.

Until recent years the Klondike region—as large as France—was practically a *terra incognita,* traversed by a few Esquimaux, Indians, and half-breeds, and here and there a white fox-hunting trapper. The bears had the district pretty well to themselves. In or about 1878 the first gold-prospector entered the country, and from that time onwards small parties of miners made their way into the Klondike over the Chilkoot Pass from Dyea at the head of the Lynn Canal. From the outset gold was found in the bars of the Lewes River (the upper Yukon) and its tributaries, but generally in unremunerative amounts, considering the conditions under which mining had to be conducted in a region so remote from civilization. In

1881, however, paying "placers" were discovered on the Big Salmon River, and five years later the Cassiar Bar was tapped. In the autumn of that year miners struck "coarse" gold on Forty-Mile Creek, a feeder of the Yukon which enters it just to the east of the boundary line between Canada and Alaska. "The gold," wrote Dr. Dawson—who afterwards gave his name to the chief city of the region—"varies much in character, but is quite often coarse and nuggety, and very large amounts have been taken out in favorable places by individual miners. Few of the men mining here in 1887 were content with ground yielding less than $14 a day, and several had taken out nearly $100 a day for a short time."

A "city" quickly sprang up at Forty-Mile, whither 200 out of 250 miners of the district hastened; and another at Circle, 100 miles lower down, in Alaska. These soon expanded into places more worthy of their title.

A year which will always remain famous in mining history is 1896, when a miner named George Carmack, who had been diligently searching for eleven years, tapped the riches of the Klondike River. While roaming about with his Indian relatives and friends, he started a digging on the banks of the Bonanza Creek, and soon found enough gold in his pan to convince him that here was a fortune. He at once hurried off to Forty-Mile to register his claim, and after giving some old acquaintances the hint, he started back. This was in August, just as the winter, which would effectively bar the people of the outer world from entering, had begun.

In a few days all Forty-Mile was on the way, and soon 350 men—who had the place *all to themselves*—were shovelling at the richest-known gold deposits in the world. Never had miners had such a chance! They knew that for several months no one could arrive to share the spoil. Fortunes were made at an astounding rate. Carmack and three companions washed out $1,200 in eight days; while on the same creek two other men took $4,000 in two days. Newcomers staked out Creek claims farther and farther from the main stream of the Klondike, until the

people from Forty-Mile had all been served. Presently the miners from Circle City got wind of the find, and rushed up, suffering terribly on the way from cold and hunger.

One of the most curious things connected with this strike was the rich reward that attended an act of sheer laziness. An ex-bartender of Forty-Mile, who was too sluggish to go up to the top of the Bonanza Creek, turned aside into a subsidiary Creek, the famous Eldorado, out of which he made nearly $3,000,000.

So rich was the "pay dirt," that as much as $800 was taken out of a single pan. On one claim a nugget was picked up worth $255, and another one worth $230.

The gold took a lot of getting out, however, the ground being frozen hard as iron. Yet the digging must be done in winter, since after the spring thaw set in every shaft became a well, owing to the leakage from the upper gravel stratum, and because, though it would be impossible to wash the dirt when the thermometer was many degrees below zero, the abundance of summer water would make the "clean-up" an easy matter. While sinking the shafts the miners had to use big fires to soften the gravel. By the time a fire had burnt out, the ground below it was thawed to a depth of several inches. Pick and shovel removed all the loose dirt, which was thrown on to the "dump," ready for washing in the spring. Alternate firing and digging gradually penetrated the crust of gravel to within a few feet of the unworkable bedrock below, and then the real excitement began, for the rich pay-streak rests on the rock, which has caught all the gold washed through the ground by centuries of rain and torrential thaws.

The last eighteen inches or so of gravel is laid by itself on the dump and treated with special care, that the dust and nuggets which it contains may be secured. In deeper claims, *i. e.*, those where the rock is overlaid by very deep gravel, it would be too troublesome to dig out all the super-incumbent "poor dirt"; and small shafts are sunk to the rock, and horizontal "drifts" run from the bottom

through the rich strata. The frozen condition of the earth here aids the miner, by saving him the labor of supporting the roof of a drift with timber props.

All the winter long the miners burnt and dug, piling up great heaps of the precious dirt. With the spring began the "clean-up," which yielded most sensational results. Some men made money at the rate of *seventeen dollars a minute,* and fortunes of hundreds of thousands of dollars came out in a couple of months. One miner was found looking very disconsolate, and on being asked what ailed him he replied that for the last day or two he had been making only $60 per pan washed, in place of the $100 that his earlier washings produced!

Of all the 300 claims staked out on Bonanza Creek not one proved a failure. Many fortunes were found in the sluices and pans; and even among the refuse thrown away enough gold remained to bring wealth to any one who cared to work it over again.

At the end of the "clean-up" a large proportion of the miners were "made" men for life. Yet, by a strange irony of fortune, they were so pinched by the want of food that one man offered half his wealth in exchange for a single good square meal. The first steamer down the river carried on board nearly a hundred lucky miners, who, as mentioned above, reached San Francisco safely with their spoil. "As the United States Mint was closed for the day," writes a witness of the scene in the New York *Tribune,* "when the miners arrived, they packed their sacks of gold dust to Selby's office. There a picturesque collection of bags was produced. Some were made of deer hide, and held as much as $125,000. Several miners ran out of even canvas bags, and were forced to put their gold in tumblers and fruit jars, which they covered with writing paper. They looked like fruit or jelly put up by country housewives. All the bags were weighed, and then, as fast as the weight was recorded, they were slit open with a sharp knife, and the contents poured upon the broad counter, which had a depression in the middle. The heap of gold dust looked like a pile of yellow shelled corn."

Thousands of gold-seekers of both sexes and all classes were soon hurrying to Pacific ports, bound for Klondike, not caring *how* they should reach the happy hunting-grounds, as long as they got there. The mining towns of Colorado and California were deserted by their inhabitants, who turned what they could into money and joined the rush. The fever spread rapidly to inland towns, even to Europe and Australia. Men of all ranks threw up their ordinary occupations and shipped for Alaska. At Seattle, Washington, half the police force resigned, and the street cars had to cease running for lack of drivers.

By every mail came in fresh accounts of the Klondike wonders, some doubtless very greatly exaggerated. The following, which appeared in the *Manchester Guardian* of October 17, 1897, is, however, the statement of a responsible person, Mr. William Ogilvie, a Canadian Government Surveyor, and as such may be trusted. "Talking of the reports of wonderful accounts of gold taken out in a single pan, Mr. Ogilvie gave some of his own experiences. He went into one of the richest claims and asked to be allowed to wash out a panful of gold. The pay-streak was then very rich, but standing at the bottom of the shaft, looking at it by the light of a candle, all that could be seen of the pay-streak was a yellowish-looking dirt, with here and there the sparkle of a little gold. Mr. Ogilvie took out a big panful and began to wash it out, while several miners stood about guessing as to the result. Five hundred dollars was the top guess of the miners, but when the gold was washed, dried, and weighed, it came to a little over $590."

How were the gold-seekers to reach the land of promise? Though no fewer than nine routes were practicable in the summer, three only were generally employed. The easiest and longest was an all-water route, by steamer to the mouth of the Yukon, and thence up the river, a distance of 4,000 miles in all. This occupied any period up to a month, though, if the river steamer were unlucky, a much longer time might be required to pilot her through the many snags and sandbars lurking in the unsurveyed

channel of the Yukon. Impatient people therefore preferred the overland route—some 2,500 miles shorter—*via* the Chilkoot and White Passes of the St. Elias range. If he meant to utilize one of these, the adventurer booked a passage to Juneau, where the outfit—mining tools, cooking apparatus, clothes, guns, and large quantities of provisions sufficient to last for six months—must be purchased. Having laid out his money to the best advantage, he proceeded to Dyea or Skagway at the head of the Lynn Canal, according to whether his choice was the Chilkoot or the White Pass. At either place, owing to the shallow anchorage, the traveler often had to wade ashore. Then he rigged up a tent, and sought porters to carry his goods to the foot of the Pass. We will picture the fortunes of an 1897 gold-seeker in the Chilkoot. First came a nine-mile tramp over very rough ground to Sheep Camp, at the rate of a mile an hour. He had to make several journeys over this piece if carriers were few and his baggage bulky. This took about four days. At Sheep Camp wood was scarce and a fire sorely needed. Porters having been engaged, the mountains proper must be tackled. Absolutely no vestige of a trail existed over the snowy plateaux which rose in front, cut across by deep crevasses, the work of some raging mountain stream. If a blizzard overtook the party—as very often happened—they had to stop, roll themselves up as best they might, and wait until the storm abated. The last part of the ascent was terrible, an almost perpendicular climb up rocks where a boulder might easily be dislodged and sent crashing down on some luckless person below. "I have roughed it," said Mr. Harry de Windt[1] "for the past fifteen years in Siberia, in Borneo, and in Chinese Tartary, but I can safely describe that climb over the Chilkoot as the severest physical experience of my life."

In 1898 an aerial wire-rope tramway was established to transport baggage up this precipice, at the rate of a cent a pound.

From the top the descent inland was so precipitous that

[1] *Strand Magazine*, October, 1897.

sleighs had to be "given their head," as it was impossible to hold them back. Then came a succession of journeys to Crater Lake, from which place Lake Lindeman, the first of a chain, was soon reached; and a couple more days brought him to Lake Bennet.

The traveler's troubles were by no means over, for he must now *build a boat,* raft—something to carry him five hundred miles through lakes and rapids. This was a difficult job even for a professional boat-builder, as trees must be felled and cut into planks before he could think of beginning work on his craft. If fortunate, he might possibly pick up a ready made skiff for $100 or so. Ten chances to one there was not such a thing for sale. Of course, if the outfit did not include all proper tools and materials for caulking the boat's seams, an advance became almost impossible. Here is a picture of Lake Bennet in June, 1898: "It was a busy shipbuilding port, turning out more boats in a given time than probably any other town in the world, large or small. The skilled and the unskilled were hewing and caulking, all bent upon the one common theme of having a boat, and by means of it reaching Dawson or some place in near proximity to the goldfields. No more inspiring lesson teaching man's ingenuity and determination could be found than this one of Nature's shipyard. One and all seemed to have got suited and fitted, and within a period of some two months not less than two thousand craft—sail boats, scows, and canoes, many of the lighter ones brought bodily over the passes—were launched upon the still icy waters of Lake Bennet."[1]

Leaving the lakes, the voyager entered the Upper Yukon, and soon reached the Grand Canon Rapids, nearly a mile long, where the river is suddenly contracted to a width of 100 feet. The waves run high, and if the boat should be swamped, there is little chance of getting out, as the sides are sheer rock. From here to the White Horse Rapids, known as "The Miner's Grave," from the many casualties that have taken place in their turbulent

[1] "Alaska and the Klondike," A. Heilprin.

waters, is very bad going. At the Rapids a portage must be made. Lake Le Barge is next reached, a lovely piece of water with practically no current flowing through it. Then the river again, and its strong stream carrying the boat sixty to seventy miles a day. On past Little Salmon River to Five Finger Rapids, Rush Rapids, and Rink Rapids, after which the dangers of travel are pretty well over, and the Klondike is reached at last.

Should the White Pass have been chosen, the difficulties of the mountains were lessened, partly because the gradients are not so severe, partly because it has an altitude of over 1,000 feet less than the Chilkoot. The distance, about forty miles from Skagway, the port of landing, could, under favorable circumstances, be covered in a day and a half. From Lake Bennet the route is the same as that already described. During the "rush" of '98 this Pass was largely used; and sad traces of man's cupidity remained to mark the event. "The Desert of Sahara," writes Mr. Heilprin, after crossing the Pass in 1898, "with its lines of skeletons, can boast of no such exhibition of carcasses. Long before Bennet was reached, I had taken count of more than a thousand unfortunates (horses) whose bodies now made part of the trail; frequently we were obliged to pass directly over these ghastly figures of hide, and sometimes, indeed, broke into them. Men whose veracity need not be questioned assured me that what I saw was in no way the full picture of the 'life' of the trail; the carcasses of that time were less than one-third of the full number which in April and May gave grim character to the route to the new Eldorado. Equally spread out, this number would mean one dead animal for every sixty feet of distance! The poor beasts succumbed not so much to the hardships of the trail as to lack of care and the inhuman treatment which they received at the hands of their owners. Once out of the line of the mad rush, perhaps unable to extricate themselves from the holding meshes of soft snow and of quagmires, they were allowed to remain where they were, a food offering to the army of carrion eaters which were hover-

ing about, only too certain of the meal which was being prepared for them. Oftentimes pack-saddles, and sometimes even the packs, were allowed to remain with the struggling or sunken animal—such was the mad race which the greed of gold inspired."

After the 1897 rush Dawson, the "Francisco of the North," as it has been called, sprang up on the right bank of the Yukon in the angle between that river and the Klondike. On the opposite side of the Klondike is the town named after it. Early in 1897 Dawson was only a small group of huts, housing a few hundred miners. No less than 5,000 entered the Yukon country in the summer of that year, and about 40,000 in the summer following. By the autumn of 1898 Dawson counted at least 20,000 inhabitants, and had all the usual features of a "boom" town. That is to say, most of the buildings were of a somewhat ramshackle nature; and prices ruled high. Supplies came in very irregularly by steamers from St. Michael's. The population was not a mere horde of prospectors intent upon acquiring gold at all costs, but a medley in which Counts, naval and military officers, scientists, lawyers, pressmen, and storekeepers jostled one another. You had your choice of three weekly newspapers, several theatres (of a sort), an almost unlimited number of saloons, and a couple of banks. The insecurity of life and property usually associated with mining towns did not exist here, thanks mainly to the efficiency of the Canadian Mounted Police. So much did people trust one another, that if a purchaser entered a store, he said what he wished to have, threw his bag of gold-dust on the counter, and *turned his back* while the storekeeper weighed it out. To watch him would have been flagrantly "bad form," as implying mistrust of his honesty. One storekeeper *did* take a mean advantage of a customer, and he was promptly removed in a manner resorted to in communities where rough justice and revolvers form judge and executioner.

A Dawson hotel was not much to look at in those days; but what it lacked in comforts it made up for in charges.

A guest-room was generally innocent of looking-glass, washing apparatus, candlestick, window-panes (replaced by canvas). But for what it could boast in the way of a bed $6 a night might be asked. Board cost about $5 more a day. Yet as regards the commissariat the figure is not excessive in view of current prices. Mr. Heilprin details some of these: oranges and lemons 75 cents apiece; apples 25 cents; potatoes and onions 75 cents the pound; butter $1 the pound; eggs, presumably fresh, but ordinarily with a stale inheritance, $2.50 per dozen; Bass's ale $2.50 a pint; sugar 30 cents a pound. Water-melons not less than $25 each; and in scarce times a cucumber fetched $5. Hay touched tremendous prices —$1,400 per ton.

All this has, of course, been changed by the improvement in methods of communication. From the middle of May till the middle of October about fifty-five stern-wheel steamboats ply between Dawson and St. Michael's. The pilots know the snags, bars, and channel-ways of the Yukon as well as those of the Mississippi. As the river in its broader parts has a current of only three miles an hour, the powerful engines drive the boats up the 1,600 miles in about nine days, and down in a much shorter time. When the river freezes, the sleigh traffic begins over the smooth ice at its edge, both from St. Michael's and from the upper lakes inside the passes.

Marvelous indeed is the change that has come over the township. "It has," says a writer in *The World's Work*, speaking of the year 1903, "a splendid system of water-works, a local telephone system, and long-distance connections with the principal mines; telegraphic communication with the world, churches of every denomination, large Federal and Municipal buildings and good schools. The streets are all thoroughly lighted by electricity. Lines of steamboats along the wharves, loading and unloading, and steam dredges at work in the river, give an animated aspect to the water-front. Three years ago the inhabitants of Dawson lived principally on dried and canned meats and German sliced evaporated potatoes.

To-day fresh meat is brought in, frozen in winter, and in refrigerator cars to White Horse in summer, and all vegetables are grown in market gardens near by. Nothing pleases the Dawson citizen more than to entertain a skeptical visitor from the South at table with lettuce, asparagus, green peas, or celery, cauliflower, cabbage and carrots, according to the season, grown in his own rear-yard."[1]

About three miles up the Klondike River from Dawson is the Bonanza Creek, the scene of the first important finds. Following the Bonanza thirteen miles or so the Eldorado Creek is struck. The trail formerly used by the miners was much impeded by morasses, through which the pedestrian ploughed his way, trusting to his high waterproof boots to keep out most of the wet. But matters have been much improved since then, and the claim-owner reaches his property without much trouble. In winter sleighs are largely used over the streams, up which a good dog-team will make the journey to Eldorado in three hours.

Already the iron horse has arrived. In June 1898 a syndicate of English capitalists began work on what is now known as the White Pass and Yukon Railway, running from Skagway through the mountains to Lake Bennet. Though its length is but 112 miles, it ranks high as an engineering achievement; possibly it was the most difficult bit of railway work ever performed. While clearing the trail for the track the navvies had to collect about 2,000 dead horses into heaps and burn them with kerosene. Parts of the railway cost $250,000 a mile, the total expenditure reaching $5,000,000. So much needed was the road, however, that the first two years' running showed profits of $2,000,000; and shares which at one time had been going begging at $6.50 sold at $750 apiece.

The track-builder is hard at work in other parts of Alaska. From Nome to Anvil Creek, a five-mile line has been laid, "The Wild Goose Road," which in spite of its title has also proved a very good dividend earner. Sew-

[1] November, 1903.

ard Peninsula, on which Nome, a city of 25,000 inhabitants, is built, will shortly be gridironed by railways leading to and from the principal gold-mines, and forming the western feeders of a main trans-Alaskan system. In 1892 a track 82 miles long stretched from West Dawson to Stewart River, from which point to the Lakes the iron horse will probably soon be running. A railway has also been planned from Valdez, the most northerly ice-free port of Alaska, to Tanana on the Yukon, 430 miles away; and, more ambitious still, a great artery running southwards to join the Canadian trans-continental rails. When these schemes are completed it will be possible to travel continuously from Ottawa or New York to Nome, and on to the westernmost point of Alaska, whence a submarine tunnel under the Bering Straits would provide a still longer run of several thousand miles to Paris.

Alaska may be cold, mosquito infested, fly-bitten, but she is well worth the $7,150,000 paid by the United States to Russia in 1867. A great future lies before her, one in which the gold industry may eventually recede into the background. Yet the day when George Carmack lit his campfire, burnt away the moss, and discovered the rich gravel, is that from which the new era will be dated. As California and Australia were "boomed" by their gold rushes, and have since gained the larger part of their wealth from agricultural and grazing pursuits, so may the Yukon district be known to our descendants as one of the great wheat and timber-producing countries of the world.

# THE PERUVIAN ANDES.

BY

A. GALLENGA.

Mr. Gallenga was an English journalist who traveled far and wide in the service of "The Times" newspaper. He wrote "The Pearl of the Antilles," "Country Life in Piedmont," as well as many other books, chiefly of travel.

THE mere name of "the Andes" tasks from earliest youth all the active faculties of a man's imagination. Passionately fond, as I always was from native instinct, of mountain scenery, even while revelling on the beauties of the Apennines, the Alps, or the Pyrenees, I, with the same eagerness with which Virgil, from what he knew of his Provincial Mantua, evolved his idea of Metropolitan Rome, from what I saw near home, for many years endeavored to conjure up before my mind's eye the image of what might be this remote mountain chain, which was then held to be the loftiest, and which is still the longest, and in many respects the greatest, in the world.

Behold me now at home in the Andes! A journey which till lately would have taken months of toil and danger is in our days accomplished by a few hours of easy and perfectly safe railway traveling. I set out from Lima on a Wednesday afternoon by a special engine on the Oroya line, and arrived before evening at the Matucana station, 101 kilometres from Callao, and 2374 metres above the level of the sea. I proceeded early on the following morning to Chicla, the furthest spot which the railway has hitherto reached, 140 kilometres from Callao, and 3710 metres above the sea level. At Chicla I took horses, and by a four or five hours' ride came to the summit of the Pass, 169 kilometres from Callao, and at a height of 4896 metres (about 16,300 English feet) above

From "South America." London.

the sea, and 838 feet above the uppermost 3849 feet long tunnel, which the line is intended to reach, and to which the earthworks have already been extended. I traveled under the best auspices. I had with me three wise guides and instructors, M. Malinowski, a Pole, the chief engineer who planned and executed all the works of the line; Mr. Cilley, its general superintendent; and Signor Antonio Raimondi, an Italian, more learned in the mineralogy, geography, history and economy of the country than any native Peruvian. These gentlemen, as they were the most useful, so they proved also the most courteous, obliging, and genial companions.

The Andes, as the reader knows, constitute an uninterrupted Cordillera, or mountain chain, or net of chains, stretching all along the South American Continent, from Tierra del Fuego and the Strait of Magellan, in the extreme south, to the sea-board of Colombia and the Caribbean Sea, adjoining the Isthmus of Panama, in the north. Its length is (from latitude 10 deg. N. to 56 deg. S.) 66 degrees, about 4500 miles; and it runs from north to south, close to the Western or Pacific shore, falling on this side in precipitous ridges and through narrow rocky glens, almost close to the water's edge, while it slopes with gentler declivity on the other side, forming broad valleys, and traversing vast plains, all its waters joining in three great streams, the Orinoco, the Amazon, and the Parana or Plate.

Between the mountains of the Old World and those of the American continent there is this main difference, that, while most of the great chains of Europe, Asia, and Africa run from east to west, nearly all those of North or South America run from north to south. By this peculiarity the climate and the very aspect of the two continents are in a great measure affected. The chains that separate Central from Southern Europe, the Pyrenees and the Alps in all their offshoots as far as the Balkans, act as so many fencing walls, checking the impetuosity of the winds and tempering the heat and cold of each region so as to best fit it to the exigencies of the vegetable and animal life

which it was destined to develop. In Italy, for instance, the Alps protect Piedmont and Lombardy from the extreme rigor of German frosts; and a journey from Milan or Turin to Genoa in the winter months, owing to the shelter of the interjacent Apennines, is often suggestive of a sudden transition from the Poles to the Tropics. In Spain, a country crossed from east to west by five parallel sierras, the change of climate is equally perceptible at each successive zone and at a few miles' interval, and the progress of heat and cold does thus pretty fairly keep pace with the scale of latitude.

Here, in this Southern continent, the same wind from the South Pole blows throughout the year, fresh and keen, all along the coast; so fresh and keen that on the sea or close to it the vertical sun of the Tropics loses all its power even at noon, and the long equatorial night has a chill which renders it unsafe as well as uncomfortable to sleep in the open, and unwise and almost impossible to dispense with heavy blankets.

There is a warm and moist, generally unhealthy, rainy season in the West Indies, along that part of the coast which bears the name of the Spanish Main, and, as a rule, wherever the influence of unimpeded sea air is felt. But on this western coast of South America the vapors that would be wafted up to it from the Pacific are met by the perennial breezes which, as I said, come up from the Pole, and they are driven upwards till they reach the summit of the mountain wall of the Andes, where, condensed by the cold of that lofty region, they fall in copious rain, drenching and fertilizing the eastern water-shed, passing over the western slope, and leaving it untouched, arid, barren, and desolate. For the six winter months in the year, what in the West Indies is the rainy season is here the season of clouds and fogs. We have the constant threat of rain with hardly ever a drop of it, and the sun, that breaks out in pale glimpses towards noon, is seen but not felt. This is especially the case with Peru, the coast of which, projecting westward in all its length from Arica to Paita, is more immediately exposed to the polar wind

and more unmercifully searched and blighted by its blast. That its climate, as a tropical one, may be all the better for it, is very possible; and, indeed, there is no fault to be found with it on the score of human health; but it is dull and gloomy and doomed to perpetual drought. There is no moisture or dew in the land, and consequently no vegetation, or only that which is fostered by the scanty rills creeping through the sand and stone of their narrow glens, and only rushing down, torrent-fashion, when the thaw of the perpetual snows of the Cordillera sets in in good earnest in the summer months.

On the other side of the mountains, across the Cordillera, or rather the several parallel lines of Cordilleras, and across the table-land which spreads far and wide between them, one comes to the so-called "*Montaña,*" or Eastern slope of the Andes, "nearly," as it has been described, "an unknown, impenetrable forest, with rosewood, mahogany, calisaya, rubber trees, coffee, cocoa, and coca bushes, a land of unequalled fertility, drained by the principal sources of the Amazon."

The railway which comes up from Callao to Lima runs along the banks of the Rimac, a mountain stream the valley of which, after leaving the last town bridge, gradually widens and expands into a plain, blooming with rich tropical vegetation, and cultivated in slovenly patches by the kitchen gardeners who supply the capital with fruit and vegetables. Before we reached Santa Clara, 29 kilometres from Callao, we passed a cotton plantation and a sugar-mill. As far as Chosica, 55 kilometres from Callao, the line ascends straight and smooth, gradually attaining a height of 895 metres. The hills close in on all sides, every trace of vegetation, except on or very near the bed of the river, disappears, and the valley assumes that bare, bleak, savage aspect that characterizes it to the very summit. The mountains are huge rugged masses, mostly round, and all very steep and precipitous, yet seldom perpendicular, and their sides are here and there seamed with deep chasms, called *quebrados,* bearing some resemblance to dry watercourses, though few of them can

boast a thread of water; and they must be the result of convulsions, floods, or eruptions of which there hardly remains any distinct and authentic account in men's memory. Near the opening of many of these glens one can descry ruins of buildings, hamlets, or cemeteries, very puzzling to the ingenuity of archæologists, but which seem to have belonged to native races in existence before the period of the Incas, when the western slope of these mountains is supposed to have harbored a larger population than it ever afterwards numbered. A little above Chosica the valley divides into two branches, one of which, on our left, bears the name of St. Eulalia, while the one we followed, on the right, is the main valley, and its river is called the Rimac to the summit. Soon after entering the narrow dell, at San Pedro, Sta. Ana, and Cocachacra, begin the difficulties the engineer's art had to contend with. . . .

The general opinion now is that wherever a man has made a path he can make a railway. But man's path across a mountain-chain usually follows the course of the waters, and as a path—the shortest across the Andes—from time immemorial led up from Lima to the summit along the Rimac, it was along the Rimac that the locomotive had to run up. But the Rimac, which has only a gradual fall of 3 to 5 per cent. in its lower course, comes down in cataracts of 10 or 12 per cent. in the upper region, and the valley is throughout so narrow and abrupt as barely to make room for more than the stream and the path between the huge mountain masses that bulge and crowd and tower upon it on all sides.

To satisfy one's self that the works through which such obstacles were overcome are truly Titanic, it will be enough to state that, while from Callao to Oroya the distance in a straight line is only 145 kilometres, the railway follows a course of 219 kilometres, 74 of these being thus taken up by the windings and turnings, the zig-zags and tourniquets, the bridges and viaducts, the straight, curved, and horse-shoe-shaped tunnels—61 tunnels—to which the engineer had recourse to advance on his heav-

enward path. And from St. Bartolomé to Oroya, where the direct distance was only 77 kilometres, but where the difficulties to be overcome were most formidable, the railway has to go over 144 kilometres of ground, nearly double the extent of the footway having to be run over by the rail in obedience to the necessities of the ground itself. Be it observed also that the iron road is an uninterrupted upward slope from end to end, the gradients being seldom less than three, and never more than 4 per cent.; so that, although the ordinary trains from Callao to Chicla employ seven or eight hours to get over the 140 kilometres' distance, a special engine, or a "handcar" without engine, can run down from Chicla to Callao in little more than two hours, notwithstanding frequent stoppages at swing-tables on some of the turnings, going at the rate of 50 to 60 miles an hour "in perfect safety." This descent I achieved myself, on my journey back, all the way from Chicla to Matucana, under the pilotage of Mr. Cilley; and in spite of all assurance of "perfect safety," a somewhat nervous feat it seemed to me.

The "handcar," a light, small, and low railway truck, with two low-backed seats and room for two in each, moving with the ease of a chariot in the so-called "Montagnes Russes," upon a gentle push from behind acquires, after a few yards' slope, a *momentum* of which it would be awful to foretell the consequences were it not for the "brakes" with which it is supplied like an engine, and by which the driver has power to pull up in a few seconds and within a few yards of any point he may reach in his headlong career. But the driver himself, being human, delights in that entrancing rapidity of motion, and is soon almost unconsciously swayed by the fiery instincts of a racing horse. Away you go along this curve, away you tear around that corner, away you rush and dash from turning to turning, through this cutting and through that tunnel, with your face barely one foot from the hard jagged rocks of the cutting on your right, and your knees barely one foot from the brink of the dizzy precipice on your left; down you plunge into the pitch-dark tunnel,

yourself without a light, without a "cow-catcher," without a bell or whistle to scare away the stray cattle that often run to it for shelter; away you go, neck or nothing, till all your terrors are shaken from you, and you become a convert to the "perfect safety" doctrine; or till, with a fatalist's sullen courage, you set your teeth hard, you fold your arms on your breast, and almost urge the driver to more speed, as if thinking that if there is to be a smash it may just as well be now as by-and-by.

Not a little of the savage grandeur of the scenery through which the way is carved would pall upon us from its sameness were it not for the sense of the power man's genius has put forth in its contest with the most portentious works of nature. Here you have the gallant little special engine rattling up at full speed against a maze of huge rocks, where you absolutely see no issue, when she suddenly backs, and threads her way on a higher zig-zag path on the right, then on another still higher zig-zag on the left, and so on for four or five zig-zags and as many tunnels one above the other on the same mountain-side, the track which you are to follow with all its windings and turnings and its tunnel-mouths being visible before you and above you at an immeasurable height, and that which you have just left yawning in your rear at an unfathomable depth beneath; and you feel that your progress is along an immense staircase, of which the invisible summit may reach heaven and the bottom be lost in the abyss.

From one mountain to the other you cross over fearful chasms like that of Verrugas, where the glen and torrent of that name are spanned over by an iron bridge 525ft. in length, at a height of 252ft.; or like the gap of Infernillo, where the main stream breaks through two perpendicular walls of solid rock, 1,500ft. high, the train crossing from wall to wall, out of the tunnel on one side into the tunnel on the opposite side, over a bridge 160ft. long, suspended in mid-air 165ft. above the churning cataract.

The very swiftness with which you are whirled along that dismal mountain scenery doubtless adds to its grandeur by crowding together the objects in a kind of phantas-

magorial confusion, and throwing in that element of terror which lies at the root of all sublimity. When we alighted at Chicla, and taking to the saddle we proceeded at a foot's pace to the summit, I was better able to analyze my sensations, and to take a more sober view of the real character of this Andean region. The mountains around me were, and had been all along my progress, certainly very high; but in proportion as they rose I also reached a greater altitude; the walls of rock that seemed to crush me on all sides were more or less of the same dimensions, and if now and then through that wilderness of cliffs and crags and ravines I caught here a glimpse and there another of the loftiest peaks, there was little either in their size or shape to appall the senses or to stir the imagination. It was only rock, mostly bare gray rock everywhere without relief or foreground; volcanic formation, solid at the core, slightly crumbling on the surface; round shapes, steep enough to be almost inaccessible, yet only in rare instances assuming the picturesqueness of bold perpendicular lines.

Even on the summit, near the limit of perpetual snows, and where the ground lay somewhat more open before me, the scene was rather bleak than grand; the mountains of which I trod the skirts did not rise more than 2000ft. or 3000ft. above me; snow lay in the clefts between their aiguilles and pinnacles of rock, and a great sheet of ice, a veritable glacier, slid down the straight slope of one of them; while in others, further off, the snow lay in a compact mass as far as eye could reach; but there had been nothing in my progress to prepare me for the wildness of that upper region by the contrast of the amenity of the lower grounds. From the moment I had left Lima I had seen nothing but rock; here I saw nothing but rock and snow. The fringe of green vegetation, which as I said, lined the banks of the stream and a few fortunate glens through which a rill trickled, dwindled and withered at a height of 9,000 or 10,000ft. The little station gardens, coaxed up with some care at Chosica, San Bartolomé, Matucana, etc., ceased altogether at Chicla, for it is the

peculiar misfortune of the Andes on this western side that on the skirts, near the sea, and for miles inland, where no rain falls, nothing grows; while on the upper grounds, where sometimes rain is plentiful, the air is too keen and cold for even the most dwarfish and most stunted vegetation to thrive. The mountain on this side is a wilderness, not indeed without its oases, but these are not sufficiently frequent and conspicuous to redeem the prevailing barrenness; and the traveller, fatigued by the dreary sameness, is compelled to declare that even if the Andes can at their summits boast twice the loftiness and real sublimity of the Alps, they have not, on their western slope, one-tenth of the variety, of the beauty, and loveliness of the Alpine valleys.

One thought forced itself on my mind as I gazed round the unmitigated ruggedness of that portentous mountain region. Mr. Prescott never, so far as I know, visited the country of which he so eloquently wrote the history. Had he even been on the spot, he was blind, and his infirmity would in a great measure have robbed him of any idea that the forbidding aspect of the country would otherwise have inevitably suggested—the idea that of all the wonders of heroism which signalized the enterprise of the conquerors of Peru, by far the greatest was their mere march across the country—the wonder that warriors weighed down by a cumbrous and ponderous suit of armor, mounted on steeds also caparisoned with half a ton of brass and iron, should have gone for weeks and months up and down these steep Andean valleys; that they should have threaded their way through these labyrinths of shepherds' paths, never before trodden by shoe-leather or horse's hoof, where to all appearances roads by day and shelter by night were hardly anywhere to be had for scores and scores of miles round, and in defiance of a hostile population, which, however naked and unwarlike, even if arrows and javelins were of no avail, could easily at every step have crushed that mere handful of men by simply dropping on their heads the loosened masses of rock everywhere hanging on the brow of the hills above

the few inches of ground of the glen, where it was possible for the venturous invader to rest his foot! . . .

The country on the ascent from Arequipa to the crest of the Peruvian Andes at Vincomaya exhibits everywhere the same barren and forbidding aspect; but the summit itself is almost level, and not far beyond it are some of those lonely little lakelets or tarns, which on mountain-crests frequently mark the parting of the waters. The further advance lies along a broad, open valley, through which runs the Rio Suchez, and this gradually merges into the great table-land, many hundred miles in extent, of which the Titicaca Lake is the centre. This lake may be considered, both geographically and historically, the heart of Peru. It is about 180 miles in length and 60 miles in its greatest width, its surface approaching in extent that of Ontario, Erie, and other North American lakes. It is encompassed all around by rocky mountains of no great elevation, above which here and there all-round views are caught of the snowy Cordilleras. The waters flowing on all sides into this beautiful reservoir have only one outlet, the Desaguadero or Emissary, which runs to the south-east into another lake (the Poo-po Lake), beyond which its waters are supposed to be lost in some subterranean channel, and hence to find their way somewhere into the Pacific Ocean. These lakes have not yet been properly and thoroughly surveyed, and hardly any maps or charts exist on which safe reliance may be laid. The very boundaries between Peru and Bolivia, each of which claims possession of half the lake and its coasts, are imperfectly defined and perpetually shifting, neither State keeping Custom-houses or military posts on many of its ports. I crossed the lake from Puno to Chililaya, a distance of 117 miles, by one of the elegant little steamers of the Speedie Company, and returned by another boat on a circumnavigation voyage, touching at Desaguadero and other points of great interest, after extending my journey by land across the table-land from Chillilaya to La Paz, a distance of 48 miles, by a coach drawn by spanking teams of six and even eight horses, all admirably appointed.

# THE EXPEDITION OF BARON DE BOUGAINVILLE

BY

JULES VERNE.

Jules Verne was more than a writer of those numerous romances which young folks love so well. He wrote also several plays and was thoroughly at home in the literature of exploration and discovery, on which subject he wrote several interesting volumes. The Baron de Bougainville was the son of the famous first French circumnavigator who was made a Senator and a Count of the Empire by Napoleon I.

It is particularly interesting and instructive to follow the story of this expedition with a map of the world before one — marking out the route. It will be seen that the voyage was practically a circumnavigation of the globe.

THE expedition, the command of which was entrusted to Baron de Bougainville, was, strictly speaking, neither a scientific voyage nor a campaign of discovery. Its chief purpose was to unfurl the French flag in the extreme East, and to impress upon the governments of that region the intention of France to protect her nationalities and her interests, everywhere and at all times. The chief instructions given to the commander were that he was to convey to the sovereign of Cochin-China a letter from the King, together with some presents, to be placed on board the frigate Thetis.

On the 2d of March, 1824, the Thetis quitted the roads at Brest to take up at Bourbon her companion, the Espérance, which, having started some time before, had set sail for Rio de Janeiro. A short stay at Teneriffe, where the Thetis was only able to purchase some poor wine and a very small quantity of the provisions needed; a view of the Cape Verd islands and the Cape of Good Hope in the distance, and a hunt for the fabulous island of Saxemberg, and some rocks no less fictitious, were the only in-

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cidents of the voyage to Bourbon, where the Espérance had already arrived.

Bourbon was at this time so familiar a point with the navigators that there was little to be said about it, when its two open roads of St. Denis and St. Paul had been mentioned. St. Denis, the capital, situated on the north of Bourbon, and at the extremity of a sloping table-land, was, properly speaking, merely a large town, without enclosure or walls, and each house in it was surrounded by a garden. There were no public buildings or places of interest worth mentioning except the governor's palace, situated in such a position as to command a view of the whole road; the botanic garden and the "Jardin de Naturalisation," which dates from 1817. The former, which is in the centre of the town, contains some beautiful walks, unfortunately but little frequented, and it is admirably kept. The eucalyptus, the giant of the Australian forests, the Phormium tenax, the New Zealand hemp-plant, the casuarina (the pine of Madagascar), the baobab, with its trunk of prodigious size, the carambolas, the zapota, the vanilla, combined to beautify this garden, which was refreshed by streams of sparkling water. The second, upon the brow of a hill, formed of terraces rising one above the other, to which several brooklets give life and fertility, was specially devoted to the acclimatization of European trees and plants. The apple, peach, apricot, cherry, and pear-trees, which have thriven well, have already supplied the colony with valuable shoots. The vine was also grown in this garden, together with the tea-plant, and several rarer species, amongst which Bougainville noted with delight the "Laurea argentea," with its bright leaves.

On the 9th of June the two vessels left the roads of St. Denis. After having doubled the shoals of La Fortune and Saya de Malha, and passed off the Seychelles, whilst among the atolls to the south of the Maldive islands which are level with the surface of the water and covered with bushy trees ending in a cluster of cocoas, they sighted the island of Ceylon and the Coromandel coast, and cast anchor before Pondicherry.

This part of India is far from answering to the "enchantress" idea which the dithyrambic descriptions of writers who have celebrated its marvels have led Europeans to form. The number of public buildings and monuments at Pondicherry will scarcely bear counting, and when one has visited the more curious of the pagodas, and the "boilers," whose only recommendation is their utility, there is nothing very interesting, except the novelty of the scenes met with at every turn. The town is divided into two well-defined quarters. The one called the "white town," dull and deserted in spite of its coquettish-looking buildings, and the far more interesting "black town," with its bazaars, its jugglers, its massive pagodas, and the attractive dances of the bayadères. . . .

The Thetis and the Espérance quitted the roadstead of Pondicherry on the 30th of July, crossed the Sea of Bengal, sighted the islands of Nicobar and Pulo-Penang with its free port capable of holding 300 ships at a time. They then entered the Straits of Malacca and remained in the Dutch port of that name from the 24th to the 26th of July, to repair damages sustained by the Espérance, so that she might hold out as far as Manilla. The intercourse of the explorers with the resident and the inhabitants generally were all the more pleasant that it was confirmed by banquets given on land and on board the Thetis in honor of the kings of France and the Netherlands. The Dutch were expecting soon to cede this station to the English, and this cession took place shortly afterward. It must be added, with regard to Malacca, that in point of fertility of soil, pleasantness of situation and facilities for obtaining all really necessary supplies, it was superior to its rivals.

Bougainville set out again on August 26th, and was tossed about by head-winds, and troubled alike by calms and storms during the remainder of his passage through the straits. As these latitudes were more frequented than any others by Malay pirates, the commandant placed sentries on the watch and took all precautions against surprise, although his force was strong enough to be

above fearing any enemy. It was no uncommon thing to see boats manned by a hundred seamen, and more than one merchant-ship had recently fallen a prey to these unmolested and incorrigible corsairs. The squadron, however, saw nothing to awaken any suspicions, and continued its course to Singapore.

The population of this town is a curious mixture of races, and our travelers met with Europeans engaged in the chief branches of commerce; Armenian and Arabian merchants, and Chinese; some planters, others following the various trades demanded by the requirements of the population. The Malays, who seemed out of place in an advancing civilization, either led a life of servitude, or slept away their time in indolence and misery whilst the Hindus, expelled from their country for crime, practiced the indescribable trades which in all great cities alone save the scum from dying of starvation. It was only in 1819 that the English procured from the Malayan Sultan, of Johore, the right to settle in the town of Singapore; and the little village in which they established themselves then numbered but 150 inhabitants, although, thanks to Sir Stamford Raffles, a town soon rose on the site of the unpretending cabins of the natives. By a wise stroke of policy all custom-duties were abolished; and the natural advantages of the new city, with its extensive and secure port were supplemented and perfected by the hand of man.

Indeed, Singapore was simply one large warehouse, to which Madras sent cotton cloth; Calcutta, opium; Sumatra, pepper; Java, arrack and spices; Manila, sugar and arrack; all forthwith despatched to Europe, China, Siam, etc. Of public buildings there appeared to be none. There were no stores, no careening-wharves, no building-yards, no barracks, and the visitors noticed but one small church for native converts.

The squadron resumed its voyage on the 2d of September, and reached the harbor of Cavité without any mishap. Meanwhile, M. du Camper, commander of the Espérance, who had, during a residence of some years,

become acquainted with the principal inhabitants, was ordered to go to Manila, that he might inform the Governor-General of the Philippines of the arrival of the frigates, the reasons of their visit, etc., and at the same time gauge his feelings toward them, and form some idea of the reception the French might expect. The recent intervention of France in the affairs of Spain placed them indeed in a very delicate position with the then governor, Don Juan Antonio Martinez, who had been nominated to his post by the very Cortéz which had just been overthrown by their government. The fears of the commandant, however, were not confirmed, for he met with the warmest kindness and most cordial co-operation from the Spanish authorities.

Cavité bay, where the vessels cast anchor, was constantly encumbered with mud, but it was the chief port in the Philippine islands, and there the Spaniards owned a very well supplied arsenal in which worked Indians from the surrounding districts, who though skillful and intelligent, were excessively lazy. Whilst the Thetis was being sheathed, and the extensive repairs necessary to the Espérance were being carried out, the clerks and officers were at Manila, seeing about the supply of provisions and cordage. The latter, which was made of "abaca," the fibre of a banana, vulgarly called "Manila hemp," although recommended on account of its great elasticity, was not of much use on board ship. The delay at Manila was rendered very disagreeable by earthquakes and typhoons, which are of constant occurrence there. On October 24th there was an earthquake of such violence that the governor, troops, and a portion of the people were compelled hastily to leave the town, and the loss was estimated at 120,000 lires. Many houses were thrown down, eight people were buried in the ruins, and many others injured. Scarcely had the inhabitants begun to breathe freely again, when a frightful typhoon came to complete the panic. It lasted only part of the night of October 31st, and the next day, when the sun rose, it might have been looked upon as a mere nightmare had not the

melancholy sight of fields laid waste, and of the harbor with six ships lying on their sides, and all the others at anchor, almost entirely disabled, testified to the reality of the disaster. All around the town the country was devastated, the crops were ruined, the trees — even the largest of them — violently shaken, the village destroyed. It was a heart-rending spectacle. The Espérance had its main-mast and mizzen-mast lifted several feet above deck, and its barricadings were carried off; the Thetis, more fortunate than its companion, escaped almost uninjured in the dreadful tempest.

The laziness of the workpeople, and the great number of holidays in which they indulge, early decided Bougainville to part for a time from his convoy, and on December 12th, he set sail for Cochin-China. Before following the French to the little-frequented shores of that country, however, we must survey with them Manila and its environs. The Bay of Manila is one of the most extensive and beautiful in the world; numerous fleets might find anchorage in it; its two channels were not yet closed to foreign vessels, and in 1798 two English frigates had been allowed to pass through them and carry off numerous vessels under the very guns of the town. The horizon is shut in by a barrier of mountains, ending on the south of the Taal, a volcano now almost extinct, but the eruptions of which have often caused frightful calamities. In the plains, framed in rice plantations, several hamlets and solitary houses give animation to the scene. Opposite to the mouth of the bay rises the town, containing 60,000 inhabitants, with its lighthouse and far-extending suburbs. It is watered by the Passig, a river issuing from Bay lake, and its exceptionally good situation secures to it advantage which more than one capital might envy. The garrison, without including the militia, consisted at that time of 2,200 soldiers; and, in addition to the Spanish navy, always represented by some vessel at anchor, a marine service had been organized for the exclusive use of the colony, to which the name of "sutil" had been given, either on account of the small size, or the fleetness

of the vessels employed. This service, all appointments in which are in the gift of the governor-general, is composed of schooners and gun-sloops, intended to protect the coasts and the trading-vessels against the pirates of Sulu. But it cannot be said that the organization, imposing as it is, has achieved any great results. Of this Bougainville gives the following curious illustration: In 1828, Suluans seized 3,000 of the inhabitants upon the coast of Luzon, and an expedition sent against them cost 140,000 piastres, and resulted in the killing of six men!

Great uneasiness prevailed in the Philippines at the time of the visit of the Thetis and Espérance, and a political reaction which had steeped the metropolis in blood, had thrown a gloom over every one. On December 20, 1820, a massacre of the whites by the Indians; in 1824, the mutiny of a regiment, and the assassination of an ex-governor, Senor de Folgueras, had been the first horrors which had endangered the supremacy of the Spanish.

The Creoles, who, with the Tagalas, were alike the richest and most industrious classes of the true native population, at this time gave just cause for uneasiness to the government, because they were known to desire the expulsion of all who were not natives of the Philippines; and when it is borne in mind that they commanded the native regiments, and held the greater part of the public offices, it is easy to see how great must have been their influence. Well might people ask whether they were not on the eve of one of those revolutions which lost to Spain her fairest colonies.

Until the Thetis reached Macao, she was harassed by squalls, gales, heavy showers, and an intensity of cold, felt all the more keenly by the navigators after their experience for several months in a temperature of 75¾° Fahrenheit. Scarcely was anchor cast in the Canton river before a great number of native vessels came to examine the frigate, offering for sale vegetables, fish, oranges, and a multitude of trifles, once so rare, now so common, but always costly.

"The town of Macao," says the narrative, "shut in

between bare hills, can be seen from afar; the whiteness of its buildings rendering it very conspicuous. It partly faces the coast, and the houses, which are elegantly built, line the beach, following the natural contour of the shore. The parade is also the finest part of the town, and is much frequented by foreigners; behind it, the ground rises abruptly, and the façades of the buildings, such as convents, noticeable for their size and peculiar architecture, rise, so to speak, from the second stage; the whole being crowned by the embattled walls of the forts, over which floated the white flag of Portugal.

At the northern and southern extremities of the town, facing the sea, are batteries built in three stages; and near the first, but a little further inland, rises a church with a very effective portico and fine external decorations. Numerous sampans, junks, and fishing-boats anchored close in shore, give animation to the scene, the setting of which would be much brightened if the heights overlooking the town were not so totally wanting in verdure.

Situated as it is on the high road, between China and the rest of the world, Macao, once one of the chief relics of Portuguese colonial prosperity, long enjoyed exceptional privileges, all of which were, however, gone by 1825, when its one industry was contraband trade in opium.

The Thetis only touched at Macao to leave some missionaries, and to hoist the French flag, and Bougainville set sail again on January 8th.

Nothing worthy of notice occurred on the voyage from Macao to Touron Bay. Arrived there, Bougainville learned that the French agent, M. Chaigneu, had left Hué for Saigon, with the intention of there chartering a barque for Singapore, and in the absence of the only person who could further his schemes he did not know with whom to open relations. Fearing failure as an inevitable result of this contretemps he at once despatched a letter to Hué, explaining the object of his mission, and expressing a wish to go with some of his officers to Saigon. The time which necessarily elapsed before an answer was

received was turned to account by the French, who minutely surveyed the bay and its surroundings, together with the famous marble rocks, the objects of the curious interest of all travelers. Touron Bay has been described by various authors, notably by Horsburgh, as one of the must beautiful and vast in the universe; but such is not the opinion of Bougainville, who thinks these statements are to be taken with a great deal of reservation. The village of Touron is situated upon the seacoast, at the entrance of the channel of Faifoh, from the right bank of which rises a fort with glacis, bastions, and a dry moat, built by French engineers.

The French being looked upon as old allies were always received with kindness and without suspicion. It had not, apparently, been so with the English, who had not been permitted to land, whilst the sailors on board the Thetis were at once allowed to fish and hunt, and to go and come as they chose, every facility for obtaining fresh provisions being also accorded to them. Thanks to this latitude, the officers were able to scour the country and make interesting observations. One of them, M. de la Touanne, gives the following description of the natives: "They are rather under than over middle height, and in this respect they closely resemble the Chinese of Macao. Their skin is of a yellowish-brown, and their heads are flat and round. Their faces are without expression, their eyes are as melancholy, but their eyebrows are not so strongly marked, as those of the Chinese. They have large flat noses and large mouths, and their lips bulge out in a way rendered the more disagreeable as they are always black and dirty from the habit indulged in, by men and women alike, of chewing areca nut mixed with betel and lime. The women, who are almost as tall as the men, have not a more pleasant appearance; and the repulsive filthiness, common to both sexes, is enough without anything else to deprive them of all attractiveness."

What strikes one most is the wretchedness of the inhabitants as compared with the fertility of the soil, and this shocking contrast betrays alike the selfishness and

carelessness of the government and the insatiable greed of the mandarins. The plains produce maize, yams, manioc, tobacco, and rice, the flourishing appearance of which testifies to the care bestowed upon them. The sea yields large quantities of delicious fish, and the forests give shelter to numerous birds, as well as tigers, rhinoceroses, buffaloes, and elephants, and troops of monkeys are to be met with everywhere, some of them four feet high, with bodies of a pearl-grey color, black thighs, and red legs. They wear red collars and white girdles, which make them look just as if they were clothed. Their muscular strength is extraordinary, and they clear enormous distances in leaping from branch to branch. Nothing can be odder than to see some dozen of these creatures upon one tree indulging in the most fantastic grimaces and contortions. "One day," says Bougainville, "when I was at the edge of the forest, I wounded a monkey who had ventured forth for a stroll in the sunshine. He hid his face in his hands and sent forth such piteous groans that more than thirty of his tribe were about him in a moment. I lost no time in reloading my gun not knowing what I might have to expect, for some monkeys are not afraid of attacking men; but the troop only took up their wounded comrade, and once more plunged into the woods."

Another excursion was made to the marble rocks of the Faifoh River, where are several curious caves, one containing an enormous pillar suspended from the roof and ending abruptly some distance from the ground; stalactites were seen, and the sound of a water-fall was heard from the further end. The French also visited the ruins of an ancient building near a grotto, containing an idol, with a passage opening out of one corner. This passage Bougainville followed. It led him into an "immense rotunda lighted from the top, and ending in an arched vault, at least sixty feet high. Imagine the effect of a series of marble pillars of various colors, some from their greenish colors, the result of old age and damp, looking as if cast in bronze, whilst from the roof hung

down creepers, now in festoons, now in bunches, looking for all the world like candelabra without the lights. Above our heads were groups of stalactites resembling great organ-pipes, altars, mutilated statues, hideous monsters carved in stone, and even a complete pagoda, which, however, occupied but a very small space in the vast enclosure. Fancy such a scene in an appropriate setting, the whole lit up with a dim and wavering light, and you can perhaps form some idea how it struck me when it first burst upon me."

On the 20th of January, 1825, the Espérance at last rejoined the frigate; and, two days later, two envoys arrived from the court at Hué, with orders to ask Bougainville for the letter of which he was the bearer. But, as the latter had received orders to deliver it to the Emperor in person, this request involved a long series of puerile negotiations. The formalities by which the Cochin-Chinese envoys were, so to speak, hemmed in, reminded Bougainville of the anecdote of the envoy and the governor of Java, who, rivalling each other in their gravity and diplomatic prudence, remained together for twenty-four hours without exchanging a word. The commander was not the man to endure such trial of patience as this, but he could not obtain the necessary authorization of his explorations, and the negotiations ended in an exchange of presents, securing nothing in fact but an assurance from the Emperor that he would receive with pleasure a visit of the French vessels to his ports, if their captain and officers would conform to the laws of the Empire. Since 1817 the French had been pretty well the only people who had done any satisfactory business with the people of Cochin-China, a state of things resulting from the presence of French residents at the court of Hué, on whom alone of course depended the maintenance of the exceptionally cordial relations so long established between them and the government to which they were accredited.

The two ships left Touron Bay on the 17th of February for the Anambas Archipelago, which had not as yet been

explored; and, on the 3d of March, they came in sight of it, and found it to bear no resemblance whatever to the islands of the same name, marked upon the English map of the China Sea. Bougainville was agreeably surprised to see a large number of islands and islets, the bays, etc., of which were sure to afford excellent anchorage during the monsoons. The explorers penetrated to the very heart of the archipelago, and made a hydrographic survey of it. Whilst the small boats were engaged upon this task, two prettily built canoes approached, from one of which a man of about fifty came on board the Thetis, whose breast was seamed with scars, and from whose right hand two fingers were missing. The sight of the rows of guns and ammunition, however, so terrified him that he beat a hasty retreat to his canoe, though he had already got as far as the orlop deck. Next day two more canoes approached, manned by fierce-looking Malays, bringing bananas, cocoa-nuts, and pineapples which they bartered for biscuits, a handkerchief, and two small axes. Several other interviews took place with islanders, armed with the kris, and short two-edged iron pikes, who were very evidently pirates by profession. . . .

At Surabaya the explorers were met with the news of the death of Louis XVIII. and the accession of Charles X. As the cholera, which had claimed 300,000 victims in Java in 1822, was still raging, Bougainville took the precaution of keeping his crew on board under shelter from the sun, and expressly forbade any intercourse with vessels laden with fruit, the use of which is so dangerous to Europeans, especially during the rainy season then setting in. In spite of these wise orders, however, dysentery attacked the crew of the Thetis, and too many fell victims to it.

The town of Surabaya is situated one league from the mouth of the river, and it can only be reached by towing up the stream. Its approaches are lively, and everything bears witness to the presence of an active commercial population. An expedition to the island of Celebes having exhausted the resources of the government and the

magazines being empty, Bougainville had to deal direct with the Chinese merchants, who are the most bare-faced robbers on the face of the globe, and now resorted to all manner of cunning and knavery to get the better of their visitors. The stay at Surabaya, therefore, left a very disagreeable impression on all. It was quite different, however, with regard to the reception met with from the chief personages of the colony, for there was every reason to be satisfied with the conduct of all connected with the government.

To go to Surabaya without paying a visit to the Sultan of Madura, whose reputation for hospitality had crossed the seas, would have been as impossible as it is to visit Paris without going to see Versailles and Trianon. After a comfortable lunch on shore, therefore, the staff of the two vessels set out in open carriages and four; but the roads were so bad and the horses so worn out that they would many a time have stuck in the mud if the men stationed at the dangerous places had not energetically shoved at the wheels. At last they arrived at Bankalan, and the carriages drew up in the third court of the palace at the foot of a staircase, at the top of which the hereditary prince and the prime minister awaited the arrival of the travelers. Prince Adden Engrate belonged to the most illustrious family of the Indian Archipelago. He wore the undress uniform of a Java chief, consisting of a long flowered petticoat of Indian make, scarcely allowing the Chinese slippers to be seen, a white vest with gold buttons, and a small skirted waist-coat of brown cloth, with diamond buttons. A handkerchief was tied about his head, on which he wore a visor-cap, his ease and dignity of bearing alone saving him from looking like the grotesque figure of a carnival amazon. The palace or "kraton" consisted of a series of buildings with galleries, kept delightfully cool by awnings and curtains, whilst lustres, tasty European furniture, pretty hangings, glass and crystal ornaments decorated the vast halls and rooms. A suite of private apartments, with no opening to the court, but with a view of the gardens, is reserved for the "Ratu" (sovereign) and the harem.

The reception was cordial, and the repast, served in European style, was delicious. "The conversation," says Bougainville, "was conducted in English, and many toasts were proposed, the prince drinking our healths in tea poured from a bottle, and to which he helped himself as if it had been Madeira. Being head of the church as well as of the state, he strictly obeys the precepts of the Koran, never drinking wine, and spending a great part of his time at the mosque; but he is not the less sociable, and his talk bears no trace of the austerity to be expected in that of one who leads so regular a life. The life is not, however, all spent in prayer, and the scenes witnessed by us would give a very false impression if we did not know that great latitude is allowed on this point to the followers of the prophet."

In the afternoon the Frenchmen visited several coach-houses, containing very handsome carriages, some of which, built on the island, were so well made that it was absolutely impossible to distinguish them from those which had been imported. Some archery was then witnessed, and joined in, after which, on the return to the palace, the visitors were welcomed by the sound of melancholy music, speedily interrupted, however, by the barking and fantastical dancing of the prince's fool, who showed wonderful agility and suppleness. To this dance, or rather to these postures of a bayadère, succeeded the excitement of vingt-et-un, followed by well-earned repose. Next day there were new entertainments and new exercises; beginning with wrestling-matches for grown men and for youths, and proceeding with quail-fights, and feats performed by a camel and an elephant. After lunch Bougainville and his party had a drive and some archery, and witnessed sack-races, basket-balancing, etc. In this way, they were told, the sultan passed all his time. Most striking is the respect and submission shown by all to this sovereign. No one ever stands upright before him, but all prostrate themselves before addressing him. All his subjects do but "wait at his feet," and even his own

little child of four years clasps his tiny hands when he speaks to his father.

While at Surabaya, Bougainville took the opportunity of visiting the volcano of Brumo, in the Tengger Mountains; and this excursion, in which he explored the island for a hundred miles, from east to west, was one of the most interesting undertaken by him. Surabaya contains some curious buildings and monuments, most of them the work of a former governor, General Daendels; such are the "Builder's Workshop," the "Hotel de la Monnaie" (the only establishment of the kind in Java), and the hospital, which is built on a well-chosen site, and contains 400 beds. The island of Madura, opposite to Surabaya, is at least 100 miles in length, by fifteen or twenty in breadth, and does not yield produce sufficient to maintain the population, sparse as it is. The sovereignty of this island is divided between the sultans of Bankalan and Sumanap, who furnish annually six hundred recruits to the Dutch, without counting extraordinary levies.

On the 20th of April, symptoms of dysentery showed themselves amongst the crews. Two days later therefore the vessel set sail, and it took seven good days to get beyond the straits of Madura. They returned along the north coast of Lombok, and passed through the Allas Straits, between Lombok and Sumbawa. The first of these islands, from the foot of the mountains to the sea, presents the appearance of a green carpet, adorned with groups of trees of elegant appearance, and upon its coast there is no lack of good anchorage, whilst fresh water and wood are plentiful. On the other side, however, there are numerous peaks of barren aspect, rising from a lofty table-land, the approach to which is barred by a series of rugged and inaccessible islands, known as Lombok, the coral-beds and treacherous currents about which must be carefully avoided. Two stoppages at the villages of Baly and Peejow, with a view to taking in fresh provisions, enabled the officers to make a hydrographical chart of this part of the coast of Lombok. Upon leaving the strait, Bougainville made an unsuccessful search

for Cloates Island. That he did not find it was not very wonderful, as during the last eight years many ships have passed over the spot assigned to it upon the maps. The "Triads," on the other hand, i. e., the rocks seen in 1777 by the Freudensberg Castle, are, in Captain King's opinion, the Montepello Islands, which correspond perfectly with the description of the Danes.

The Thetis and Espérance were pursued by bad weather as far as Hobart Town, the chief English station upon the coast of Tasmania, where the commander was very anxious to put in. He was, however, driven back by storms to Port Jackson, which is marked by a very handsome lighthouse, a granite tower seventy-six feet high, with a lantern lit by gas, visible at a distance of nine leagues.

Sir Thomas Brisbane, the governor, gave a cordial reception to the expedition, and at once took the necessary steps to furnish it with provisions. This was done by contract at low prices, and the greatest good faith was shown in carrying out all bargains. The sloop had to be run ashore to have its sheathing repaired, but this, with some work of less importance necessary to the Thetis, did not take long. The delay was also turned to account by the whole staff, who were greatly interested in the marvelous progress of this penal colony. While Bougainville was eagerly reading all the works which had as yet appeared upon New South Wales, the officers wandered about the town, and were struck dumb with amazement at the numberless public buildings erected by Governor Macquarie, such as the barracks, hospital, market, orphanages, almshouses for the aged and infirm, the prison, the fort, the churches, government house, the fountains, the town gates, and last but not least, the government stables, which are always at first sight taken for the palace itself. There was, however, a dark side to the picture. The main thoroughfares, though well planned, were neither paved nor lighted, and were so unsafe at night, that several people had been seized and robbed in the very middle of George street, the best quarter of

Sydney. If the streets in the town were unsafe, those in the suburbs were still more so. Vagrant convicts overran the country in the form of bands of "bush-rangers," who had become so formidable that the government had recently organized a company of fifty dragoons for the express purpose of hunting them down. All this did not, however, hinder the officers from making many interesting excursions, such as those to Paramatta, on the banks of the Nepean, a river very deeply embanked, where they visited the Regent Ville district; and to the "Plains of Emu," a government agricultural station, and a sort of model farm. They went to the theatre, where a grand performance was given in their honor. The delight sailors take in riding is proverbial, and it was on horseback that the French crossed the Emu plains. The noble animals, imported from England, had not degenerated in New South Wales; they were still full of spirit as one of the young officers found to his cost, when, as he was saying in English to Sir John Cox, acting as cicerone to the party, "I do love this riding exercise," he was suddenly thrown over his horse's head and deposited on the grass before he knew where he was. The laugh against him was all the more hearty as the skillful horseman was not injured.

Beyond Sir John Cox's plantation extends the unbroken "open forest," as the English call it, which can be crossed on horseback, and consists chiefly of the eucalyptus, and acacias of various kinds. The next day, an excursion was made up the river Nepean, a tributary of the Hawkesbury, on which trip many valuable facts of natural history were obtained.

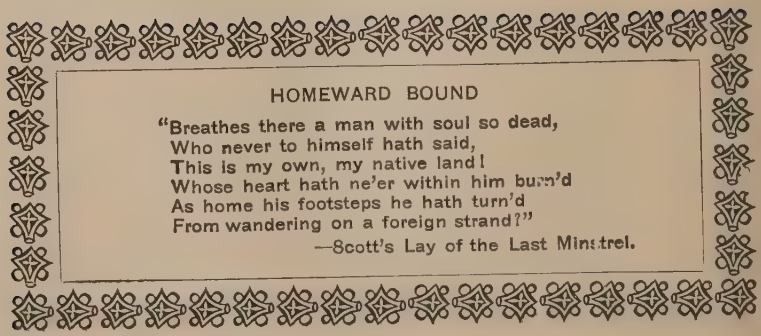
Another excursion was made in the Blue Mountains, where the famous "King's Tableland" was visited, from which a magnificent view was obtained. The explorers gained with great difficulty the top of an eminence, and an abyss of 1600 feet at once opened beneath them; a vast green carpet stretching away to a distance of some twenty miles, whilst on the right and left were the distorted sides of the mountain, which had been rudely rent asunder by

some earthquake, the irregularities corresponding exactly with each other. Close at hand foams a roaring, rushing torrent, flinging itself in a series of cascades into the valley beneath, the whole passing under the name of "Apsley's Waterfall." This trip was succeeded by a kangaroo hunt in the cow-pastures with Mr. Macarthur, one of the chief promoters of the prosperity of New South Wales. Bougainville also turned his stay at Sydney to account by laying the foundation stone of a monument to the memory of La Pérouse. This cenotaph was erected in Botany Bay, upon the spot where the navigator had pitched his camp.

On September 21st the Thetis and the Espérance last set sail; passing off Pitcairn Island, Easter Isländ, and Juan Fernandez, now a convict settlement for criminals from Chili, after having been occupied for a half century by Spanish vine-growers.

On the 23d November the Thetis, which had been separated from the Espérance during a heavy storm, anchored off Valparaiso, where it met Admiral de Rosamel's division.

Bougainville, like the Russian navigator Lütke, is of opinion that the position of Valparaiso does not justify its reputation. The streets are dirty and narrow, and so steep that walking in them is very fatiguing. The only pleasant part is the suburb of Almendral, which, with its gardens and orchards, would be still more agreeable but for the sand-storms prevalent throughout nearly the whole of the year. In 1811, Valparaiso numbered only from four to five thousand inhabitants; but in 1825 the population had already tripled itself, and the increase showed no sign of ceasing. When the Thetis touched at Valparaiso, the English frigate, the Blonde, commanded by Lord Byron, grandson of the explorer of the same name, was also at anchor there. By a singular coincidence Byron had raised a monument to the memory of Cook in the island of Hawaii, at the very time when Bougainville, the son of the circumnavigator, met by Byron in the Straits of Magellan, was laying the



HOMEWARD BOUND

"Breathes there a man with soul so dead,
Who never to himself hath said,
This is my own, my native land!
Whose heart hath ne'er within him burn'd
As home his footsteps he hath turn'd
From wandering on a foreign strand?"

—Scott's Lay of the Last Minstrel.

foundation stone of the monument to the memory of La Pérouse in New South Wales.

Bougainville turned the delay necessary for the revictualling of his division to account by paying a visit to Santiago, the capital of Chili, thirty-three leagues inland. The environs of Chili are terribly bare, without houses or any signs of cultivation. Its steeples alone mark the approach to it, and one may fancy oneself still in the outskirts when the heart of the city is reached. There is, however, no lack of public buildings, such as the Hotel de la Monnaie, the university, the archbishop's palace, the cathedral, the church of the Jesuits, the palace, and the theatre, the last of which is so badly lighted that it is impossible to distinguish the faces of the audience. The promenade, known as La Canada, has now supplanted that of L'Alameda on the banks of the river Mapocha, once the evening rendezvous. The objects of interest in the town exhausted, the Frenchmen examined those in the neighborhood, visiting the Salto de Agua, a waterfall 1200 feet in height, the ascent to which is rather arduous, and the Cerito de Santa-Lucia, from which rises a fortress, the sole defense of the town.

The season was now advancing, and no time was to be lost if the explorers wished to take advantage of the best season for doubling Cape Horn. On the 8th January, 1826, therefore, the two vessels once more put to sea, and rounded the Cape without any mishap, though landing at the Falklands was rendered impossible by fog and contrary winds. Anchor was cast on the 28th March in the roadstead of Rio Janeiro, and, as it turned out, at a time most favorable for the French to form an accurate opinion alike of the city and the court.

"The emperor," says Bougainville, "was upon a journey at the time of our arrival, and his return was the occasion of fêtes and receptions which roused the population to activity, and broke for a time the monotony of ordinary life in Rio, that dullest and dreariest of towns to a foreigner. Its environs, however, are charming; nature has in them been lavish of her riches; and the vast harbor,

the Atlantic, rendezvous of the commercial world, presents a most animated scene. Innumerable ships, either standing in or getting under weigh, small craft cruising about, a ceaseless roar of cannon from the forts and men-of-war, exchanging signals on the occasion of some anniversary or the celebration of some festival of the church, whilst visits were constantly being exchanged between the officers of the various foreign vessels and the diplomatic agents of foreign powers at the court of Rio.

The division set sail again on the 11th of April, and arrived at Brest on the 24th June, 1826, without having put into port since it left Rio Janeiro.

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## ON THE NILE IN CENTRAL AFRICA.

BY

CAPT. J. H. SPEKE.

Capt. J. H. Speke was born in England in 1827 and died in 1864. He went to the Central African Lakes with R. F. Burton in 1858, after having seen military service in India. He crossed Africa with Grant from Zanzibar over the Victoria Nyanza and down the Nile to Egypt in 1860–63. He was the discoverer of the Victoria Nyanza and the main sources of the Nile.

HERE at last I stood on the brink of the Nile. Most beautiful was the scene; nothing could surpass it! It was the very perfection of the kind of effect aimed at in a highly-kept park; with a magnificent stream from 600 to 700 yards wide, dotted with islets and rocks, the former occupied by fishermen's huts, the latter by sterns and crocodiles basking in the sun, flowing between fine high grassy banks, with rich trees and plantains in the background, where herds of the n'sunnŭ and hartebeest could be seen grazing, while the hippopotami were snorting in the water, and florikan and Guinea-fowl rising at our feet. Unfortunately, the chief district officer,

From "Journal of the Discovery of the Source of the Nile." London.

Mlondo, was from home, but we took possession of his huts — clean, extensive, and tidily kept — facing the river, and felt as if a residence here would do one good. Delays and subterfuges, however, soon came to damp our spirits. The acting officer was sent for, and asked for the boats; they were all scattered, and could not be collected for a day or two; but, even if they were at hand, no boat ever went up or down the river. The chief was away and would be sent for, as the king often changed his orders, and, after all, might not mean what had been said. The district belonged to the sakibobo, and no representative of his had come here. These excuses, of course, would not satisfy us. The boats must be collected, seven, if there are not ten, for we must try them, and come to some understanding about them, before we march up stream, when, if the officer values his life, he will let us have them, and acknowledge Kasoro as the king's representative, otherwise a complaint will be sent to the palace, for we won't stand trifling.

We were now confronting Usoga, a country which may be said to be the very counterpart of Uganda in its richness and beauty. Here the people use such huge iron-headed spears with short handles, that, on seeing one today, my people remarked that they were better fitted for digging potatoes than piercing men. Elephants, as we had seen by their devastations during the last two marches, were very numerous in this neighborhood. Till lately, a party from Unyoro, ivory-hunting, had driven them away. Lions were also described as very numerous and destructive to human life. Antelopes were common in the jungle, and the hippopotami, though frequenters of the plantain garden and constantly heard, were seldom seen on land in consequence of their unsteady habits.

The king's page again came, begging I would not forget the gun and stimulants, and bringing with him the things I asked for — two spears, one shield, one dirk, two leopard-cat skins, and two sheets of small antelope skins. I told my men they ought to shave their heads and bathe in the holy river, the cradle of Moses — the waters of which,

sweetened with sugar, men carry all the way from Egypt to Mecca, to sell to the pilgrims. But Bombay, who is a philosopher of the Epicurean school, said, "We don't look on those things in the same fanciful manner that you do; we are contented with all the commonplaces of life, and look for nothing beyond the present. If things don't go well, it is God's will; and if they do go well, that is His will also."

The acting chief brought a present of one cow, one goat, and pombé, with a mob of his courtiers to pay his respects. He promised that the seven boats, which are all the station could muster, would be ready next day, and in the meanwhile a number of men would conduct me to the shooting-ground. He asked to be shown the books of birds and animals, and no sooner saw some specimens of Wolff's handiwork, than, in utter surprise, he exclaimed, "I know how these are done; a bird was caught and stamped upon the paper," using action to his words, and showing what he meant, while all his followers n'yanzigged for the favor of the exhibition.

In the evening I strolled in the antelope parks, enjoying the scenery and sport excessively. A noble buck n'sunnŭ, standing by himself, was the first thing seen this side, though a herd of hartebeests were grazing on the Usoga banks. One bullet rolled my fine friend over, but the rabble looking on no sooner saw the hit than they rushed upon him and drove him off, for he was only wounded. A chase ensued, and he was tracked by his blood, when a pongo (bush boc) was started and divided the party. It also brought me to another single buck n'sunnŭ, which was floored at once, and left to be carried home by some of my men in company with Waganda, while I went on, shot a third n'sunnŭ buck, and tracked him by his blood till dark, for the bullet had pierced his lungs and passed out on the other side. Failing to find him on the way home, I shot, besides florikan and Guinea-chicks, a wonderful goatsucker, remarkable for the exceeding length of some of its feathers floating out far beyond the rest in

both wings.* Returning home, I found the men who had charge of the dead buck all in a state of excitement; they no sooner removed his carcass than two lions came out of the jungle and lapped his blood. All the Waganda ran away at once; but my braves feared my anger more than the lions, and came off safely with the buck on their shoulders.

Three boats arrived, like those used on the Murchison Creek, and when I demanded the rest, as well as a decisive answer about going to Kamrasi's, the acting mkungŭ said he was afraid accidents might happen, and he would not take me. Nothing would frighten this pig-headed creature into compliance, though I told him I had arranged with the king to make the Nile the channel of communication with England. I therefore applied to him for guides to conduct me up the river, and ordered Bombay and Kasoro to obtain fresh orders from the king, as all future wazungŭ, coming to Uganda to visit or trade, would prefer the passage by the river. I shot another buck in the evening, as the Waganda loved their skins, and also a load of Guinea-fowl — three, four, and five at a shot — as Kasoro and his boys prefer them to any thing.

The acting officer absconded, but another man came in his place, and offered to take us on the way up the river to-morrow, humbugging Kasoro into the belief that his road to the palace would branch off from the first stage, though in reality it was here. The mkungŭ's women brought pombé, and spent the day gazing at us, till, in the evening, when I took up my rifle, one ran after Bana to see him shoot, and followed like a man; but the only sport she got was on an ant-hill, where she fixed herself some time, popping into her mouth and devouring the white ants as fast as they emanated from their cells; for, disdaining does, I missed the only pongo buck I got a shot at, in my anxiety to show the fair one what she came for.

Reports came to-day of new cruelties at the palace.

* Named by Dr. P. L. Sclater *Cosmetornis Speckii*. The seventh pen feathers are double the length of the ordinaries, the eighth double that of the seventh, and the ninth 20 inches long. Bombay says the same bird is found in Uhiyow.

Kasoro improved on their off-hand manslaughter by saying that two kamravionas and two sakibobos, as well as all the old wakungŭ of Sunna's time, had been executed by the orders of King Mtésa. He told us, moreover, that if Mtésa ever has a dream that his father directs him to kill any body as being dangerous to his person, the order is religiously kept. I wished to send a message to Mtésa by an officer who was starting at once to pay his respects at court; but, although he received it, and promised to deliver it, Kasoro laughed at me for expecting that one word of it would ever reach the king; for however appropriate and important the matter might be, it was more than any body dare to do to tell the king, as it would be an infringement of the rule that no one is to speak to him unless in answer to a question. My second buck of the first day was brought in by the natives, but they would not allow it to approach the hut until it had been skinned; and I found their reason to be a superstition that otherwise no others would ever be killed by the inmates of that establishment.

I marched up the left bank of the Nile, at a considerable distance from the water, to the Isamba Rapids, passing through rich jungle and plantain gardens. Nango, an old friend, and district officer of the place, first refreshed us with a dish of plantain-squash and dried fish, with pombé. He told us he is often threatened with elephants, but he sedulously keeps them off with charms; for if they ever tasted a plantain they would never leave the garden until they had cleared it out. He then took us to see the nearest falls of the Nile — extremely beautiful, but very confined. The water ran deep between its banks, which were covered with fine grass, soft cloudy acacias, and festoons of lilac convolvuli; while here and there, where the land had slipped above the rapids, bared places of red earth could be seen, like that of Devonshire; there, too, the waters, impeded by a natural dam, looked like a huge mill-pond, sullen and dark, in which two crocodiles, lying about, were looking out for prey. From the high banks we looked down upon a line of sloping wooded islets lying

across the stream, which divide its waters, and, by interrupting them, cause at once both dam and rapids. The whole was more fairy-like, wild, and romantic than — I must confess that my thoughts took that shape — anything I ever saw outside of a theatre. It was exactly the sort of place, in fact, where, bridged, across from one side-slip to the other, on a moonlight night, brigands would assemble to enact some dreadful tragedy. Even the Wangŭana seemed spell-bound at the novel beauty of the sight, and no one thought of moving till hunger warned us night was setting in, and we had better look out for lodgings.

Start again, and after drinking pombé with Nango, when we heard that three wakungŭ had been seized at Kari in consequence of the murder, the march was recommenced, but soon after stopped by the mischievous machinations of our guide, who pretended it was too late in the day to cross the jungles on ahead, either by the road to the source or the palace, and therefore would not move till the morning; then, leaving us on the pretext of business, he vanished, and was never seen again. A small black fly, with thick shoulders and bullet-head, infests the place, and torments the naked arms and legs of the people with its sharp stings to an extent that must render life miserable to them.

After a long struggling march, plodding through huge grasses and jungle, we reached a district which I can not otherwise describe than by calling it a "Church Estate." It is dedicated in some mysterious manner to Lŭbari (Almighty), and although the king appeared to have authority over some of the inhabitants of it, yet others had apparently a sacred character, exempting them from the civil power, and he had no right to dispose of the land itself. In this territory there are small villages only at every fifth mile, for there is no road, and the lands run high again, while, from want of a guide, we often lost the track. It now transpired that Budja, when he told at the palace that there was no road down the banks of the Nile, did so in consequence of his fear that if he sent my whole

party here they would rob these church lands, and so bring him into a scrape with the wizards or ecclesiastical authorities. Had my party not been under control, we could not have put up here; but on my being answerable that no thefts should take place, the people kindly consented to provide us with board and lodgings, and we found them very obliging. One elderly man, half-witted — they said the king had driven his senses from him by seizing his house and family — came at once on our arrival, laughing and singing in a loose, jaunty, maniacal manner, carrying odd sticks, shells, and a bundle of mbŭgŭ rags, which he deposited before me, dancing and singing again, then retreating and bringing some more, with a few plantains from a garden, which I was to eat, as kings lived upon flesh, and "poor Tom" wanted some, for he lived with lions and elephants in a hovel beyond the gardens, and his belly was empty. He was precisely a black specimen of the English parish idiot.

At last, with a good push for it, crossing hills and threading huge grasses, as well as extensive village plantations lately devastated by elephants — they had eaten all that was eatable, and what would not serve for food they had destroyed with their trunks, not one plantain nor one hut being left entire — we arrived at the extreme end of the journey, the farthest point ever visited by the expedition on the same parallel of latitude as King Mtésa's palace, and just forty miles east of it.

We were well rewarded; for the "stones," as the Waganda call the falls, was by far the most interesting sight I had seen in Africa. Every body ran to see them at once, though the march had been long and fatiguing, and even my sketch-book was called into play. Though beautiful, the scene was not exactly what I expected; for the broad surface of the lake was shut out from view by a spur of hill, and the falls, about 12 feet deep, and 400 to 500 feet broad, were broken by rocks. Still it was a sight that attracted one to it for hours — the roar of the waters, the thousands of passenger-fish, leaping at the falls with all their might, the Wasoga and Waganda fishermen coming

out in boats and taking post on all the rocks with rod and hook, hippopotami and crocodiles lying sleepily on the water, the ferry at work above the falls, and cattle driven down to drink at the margin of the lake, made, in all, with the pretty nature of the country — small hills, grassy-topped, with trees in the folds, and gardens on the lower slopes — as interesting a picture as one could wish to see.

The expedition had now performed its functions. I saw that old Father Nile without any doubt rises in the Victoria N'yanza, and, as I had foretold, that lake is the great source of the holy river which cradled the first expounder of our religious belief. I mourned, however, when I thought of how much I had lost by the delays in the journey having deprived me of the pleasure of going to look at the northeast corner of the N'yanza to see what connection there was, by the strait so often spoken of, with it and the other lake where the Waganda went to get their salt, and from which another river flowed to the north, making "Usoga an island." But I felt I ought to be content with what I had been spared to accomplish; for I had seen full half of the lake, and had information given me of the other half, by means of which I knew all about the lake, as far, at least, as the chief objects of geographical importance were concerned.

Let us now sum up the whole and see what it is worth. Comparative information assured me that there was as much water on the eastern side of the lake as there is on the western — if any thing, rather more. The most remote waters, *or top head of the Nile,* is the southern end of the lake, situated close on the third degree of south latitude, which gives to the Nile the surprising length, in direct measurement, rolling over thirty-four degrees of latitude, of above 2,300 miles, or more than one-eleventh of the circumference of our globe. Now from this southern point, round by the west, to where the *great* Nile stream issues, there is only one feeder of any importance, and that is the Kitangŭlé river; while from the southernmost point, round by the east, to the strait, there are no rivers at all of any importance; for the traveled Arabs

one and all aver, that from the west of the snow-clad Kilimandjaro to the lake where it is cut by the second degree, and also the first degree of south latitude, there are salt lakes and salt plains, and the country is hilly, not unlike Unyamŭézi; but they said there were no great rivers, and the country was so scantily watered, having only occasional runnels and rivulets, that they always had to make long marches in order to find water when they went on their trading journeys; and farther, those Arabs who crossed the strait when they reached Usoga, crossed no river either.

There remains to be disposed of the "salt lake," which I believe is not salt, but a fresh-water lake; and my reasons are, as before stated, that the natives call all lakes salt if they find salt beds or salt islands in such places. Dr. Karpf, when he obtained a sight of the Kenia Mountain, heard from the natives there that there was a salt lake to its northward, and he also heard that a river ran from Kenia toward the Nile. If his information was true on this latter point, then, without doubt, there must exist some connection between this river and the salt lake I have heard of, and this, in all probability, would also establish a connection between my salt lake and his salt lake, which he heard was called Baringo.[1] In no view that can be taken of it, however, does this unsettled matter touch the established fact that the head of the Nile is in 3 degrees south latitude, where, in the year 1858, I discovered the head of the Victoria N'yanza to be.

I now christened the "stones" Ripon Falls, after the nobleman who presided over the Royal Geographical Society when my expedition was gotten up; and the arm of water from which the Nile issued, Napoleon Channel, in token of respect to the French Geographical Society, for the honor they had done me, just before leaving England, in presenting me with their gold medal for the discovery of the Victoria N'yanza.

[1] It is questionable whether or not this word is a corruption of Bahr (sea of) Ingo.

# LIVINGSTONE AND STANLEY IN AFRICA.

BY

DAVID LIVINGSTONE.

David Livingstone was born near Glasgow in 1813, died in Africa in 1873 and was buried in Westminster Abbey. In 1840 he went to South Africa as a missionary, remaining there nine years. From 1849 to 1856 he explored the interior of Africa. In 1864 he started on another expedition and was not heard from for years. The "New York Herald" sent Mr. Henry M. Stanley in search of him, and he was found at Ujiji in 1871 as related below.

OCTOBER 23, 1871 — At dawn off, and go to Ujiji. Welcomed by all the Arabs, particularly by Moenyegheré. I was now reduced to a skeleton; but the market being held daily, and all kinds of native food brought to it, I hoped that food and rest would soon restore me; but in the evening my people came and told me that Shereef had sold off all my goods, and Moenyegheré confirmed it by saying, "We protested, but he did not leave a single yard of calico out of three thousand, nor a string of beads out of seven hundred pounds." This was distressing. I had made up my mind, if I could not get people at Ujiji, to wait till men should come from the coast; but to wait in beggary was what I never contemplated, and I now felt miserable. Shereef was evidently a moral idiot, for he came without shame to shake hands with me, and when I refused assumed an air of displeasure, as having been badly treated; and afterward came with his "Balghere" (good-luck salutation), twice a day, and, on leaving, said, "I am going to pray," till I told him that, were I an Arab, his hand and both ears would be cut off for thieving, as he knew, and I wanted no salutations from him. In my distress it was annoying to see Shereef's slaves passing from the market with all the good things that my goods had bought.

From "The Last Journal of David Livingstone in Central Africa." Edited by Horace Waller, F. R. G. S. London.

*October 24th.*— My property had been sold to Shereef's friends at merely nominal prices. Syed bin Majid, a good man, proposed that they should be returned, and the ivory be taken from Shereef; but they would not restore the stolen property, though they knew it to be stolen. Christians would have acted differently, even those of the lowest classes. I felt, in my destitution, as if I were the man who went down from Jerusalem to Jericho, and fell among thieves; but I could not hope for priest, Levite, or good Samaritan to come by on either side; but one morning Syed bin Majid said to me, "Now this is the first time we have been alone together; I have no goods, but I have ivory; let me, I pray you, sell some ivory, and give the goods to you." This was encouraging; but I said, "Not yet, but by-and-by." I had still a few barter goods left, which I had taken the precaution to deposit with Mohamad bin Saleh before going to Manyeuma, in case of returning in extreme need. But when my spirits were at their lowest ebb the good Samaritan was close at hand, for one morning Susi came running, at the top of his speed, and gasped out, "An Englishman! I see him!" and off he darted to meet him. The American flag at the head of a caravan told me of the nationality of the stranger. Bales of goods, baths of tin, huge kettles, cooking-pots, tents, etc., made me think, "This must be a luxurious traveler, and not one at his wits' end like me."

*October 28th.*—It was Henry Moreland Stanley, the travelling correspondent of the *New York Herald,* sent by James Gordon Bennett, junior, at an expense of more than $20,000, to obtain accurate information about Dr. Livingstone if living, and if dead, to bring home my bones. The news he had to tell to one who had been two full years without any tidings from Europe made my whole frame thrill. The terrible fate that had befallen France — the telegraphic cables successfully laid in the Atlantic — the election of General Grant — the death of good Lord Clarendon, my constant friend — the proof that Her Majesty's Government had not forgotten me in voting $5,000 for supplies, and many other points of interest, revived emo-

tion that had lain dormant in Manyeuma. Appetite returned; and instead of the spare, tasteless two meals a day, I ate four times daily, and in a week began to feel strong. I am not of a demonstrative turn — as cold, indeed, as we islanders are usually reputed to be — but this disinterested kindness of Mr. Bennett, so nobly carried into effect by Mr. Stanley, was simply overwhelming. I really do feel extremely grateful, and at the same time I am a little ashamed at not being more worthy of the generosity. Mr. Stanley has done his part with untiring energy; good judgment, in the teeth of very serious obstacles. His helpmates turned out depraved blackguards, who, by their excesses at Zanzibar and elsewhere, had ruined their constitutions, and prepared their systems to be fit provender for the grave. They had used up their strength by wickedness, and were of next to no service, but rather down-drafts, and unbearable drags to progress.

*November 16th.*— As Tanganyika explorations are said by Mr. Stanley to be an object of interest to Sir Roderick, we go at his expense, and by his men, to the north of the Lake.

[Dr. Livingstone on a previous occasion wrote from the interior of Africa to the effect that Lake Tanganyika poured its waters into the Albert Nyanza Lake of Baker. At the time, perhaps, he hardly realized the interest that such an announcement was likely to occasion. He was now shown the importance of ascertaining by actual observation whether the junction really existed, and for this purpose he started with Mr. Stanley to explore the region of the supposed connecting link in the north, so as to verify the statements of the Arabs.]

*November 20th, 21st.*— Passed a very crowded population, the men calling us to land, to be fleeced and insulted by way of Mahonga or Mutuari: they threw stones in rage, and one, apparently slung, alighted close to the canoe. We came on until after dark, and landed under a cliff to rest and cook, but a crowd came and made inquiries; then a few more came, as if to investigate more perfectly: they told us to sleep, and to-morrow friendship

should be made. We put our luggage on board, and set a watch on the cliff. A number of men came along, cowering behind rocks, which then aroused suspicion, and we slipped off quietly: they called after us, as men balked of their prey. We went on five hours and slept, and then this morning came on to Magala, where the people are civil; but Mukumba had war with some one. The Lake narrows to about ten miles as the western mountains come toward the eastern range, that being about north-north-west magnetic. Many stumps of trees killed by water show an encroachment by the Lake on the east side. A transverse range seems to shut in the north end, but there is open country to the east and west of its ends.

*November 25th.*—We came on about two hours to some villages on a high bank, where Mukumba is living. The chief, young, good-looking man like Mugala, came and welcomed us. Our friend of yesterday now declared as positively as before that the water of Lusizé flowed into Tanganyika, and not the way he said yesterday! I have not the smallest doubt but Tanganyika discharges somewhere, though we may be unable to find it. Lusizé goes or comes from Luanda and Karagwé. This is hopeful, but I suspend my judgment. War rages between Mukamba and Wasmashanga, or Uasmasané, a chief between this and Lusizé; ten men were killed of Mukamba's people a few days ago. Vast numbers of fishermen ply their calling night and day as far as we can see. Tanganyika closes in except at one point north and by west of us. The highest point of the western range, about seven thousand feet above the sea, is Sumburuza. We are to go to-morrow to Lohinga, elder brother of Mukamba, near Lusizé, and the chief follows us next day.

*November 26th.*— Sunday. Mr. Stanley has severe fever. I gave Mukamba nine dotis and nine fundos. The end of Tanganyika, seen clearly, is rounded off about 4°, broad from east to west.

*November 27th.*— Mr. Stanley is better. We started at sunset westward, then northward for seven hours, and at 4 A. M. reached Lohinga, at the mouth of the Lusizé.

By the arrival of the fast Ramadân on the 14th of November, and a Nautical Almanac, I discovered that I was on that date twenty-one days too fast in my reckoning. Mr. Stanley used some very strong arguments in favor of my going home, recruiting my strength, getting artificial teeth, and then returning to finish my task; but my judgment said, "All your friends will wish you to make a complete work of the exploration of the sources of the Nile before you retire." My daughter Agnes says, "Much as I wish you to come home, I would rather that you finished your work to your own satisfaction than return merely to gratify me." Rightly and nobly said, my darling Nannie. Vanity whispers pretty loudly, "She is a chip of the old block." My blessings on her and all the rest.

I propose to go from Unyanyembé to Fipa; then round the south end of Tanganyika, Tambeté or Mbeté; then across the Chambezé, and round south of Lake Bangweolo, and due west to the ancient fountains; leaving the underground excavations till after visiting Katanga. This route will serve to certify that no other sources of the Nile can come from the south without being seen by me. No one will cut me out after this exploration is accomplished; and may the good Lord help me to show myself one of His stout-hearted servants, an honor to my children, and perhaps to my country and race.

Our march extended from December 26th, 1871, till February 18th, 1872, or fifty-four days. This was over three hundred miles, and thankful I am to reach Unyanyembé, and the Tembé Kwikuru.

I find, also, that the two head men selected by the notorious but covert slave-trader, Ludha Damji, have been plundering my stores from October 20th, 1870, to February 18th, 1872, or nearly sixteen months. One has died of small-pox; and the other not only plundered my stores, but has broken open the lock of Mr. Stanley's store-room and plundered his goods. He declared that all my goods were safe; but when the list was referred to, and the goods counted, and he was questioned as to the serious

loss, he at last remembered a bale of seven pieces of merikano, and three kaniké, or three hundred and four yards, that he evidently had hidden. On questioning him about the boxes brought, he was equally ignorant, but at last said, "Oh! I remember a box of brandy, where it went, and every one knows as well as I."

*February 18th*, 1872.—This and Mr. Stanley's goods being found in his possession, made me resolve to have done with him. My losses by the robberies of the Banian employed slaves are more than made up by Mr. Stanley, who has given me twelve bales of calico, nine loads, equal to fourteen and a half bags of beads, thirty-eight coils of brass wire, a tent, boat, bath, cooking-pots, twelve copper sheets, air-beds, trowsers, jackets, etc. Indeed, I am again quite set up; and as soon as he can send men, not slaves, from the coast, I go to my work, with a fair prospect of finishing it.

*February 20th.*—To my great joy, I got four flannel shirts from Agnes, and I was delighted to find that two pairs of fine English boots had most considerately been sent by my friend, Mr. Waller. Mr. Stanley and I measured the calico, and found that seven hundred and thirty-three and three-quarter yards were wanting, also two frasilahs of samsam, and one case of brandy. Othman pretended sickness, and blamed the dead men, but produced a bale of calico hidden in Thani's goods; this reduced the missing quantity to four hundred and thirty-six and a half yards.

*February 23d.*—Send to governor for a box which he has kept for four years: it is all eaten by white ants. Two fine guns and a pistol are quite destroyed, all the woodwork being eaten. The brandy-bottles were broken, to make it appear as if by an accident; but the corks being driven in, and corks of maize cobs used in their place, show that a thief has drunk the brandy and then broken the bottles. The tea was spoiled, but the china was safe, and the cheese good.

*March 14th.*—Mr. Stanley leaves. I commit to his care my journal sealed with five seals: the impressions on

them are those of an American gold coin, anna, and half anna, and cake of paint with royal arms. Positively not to be opened.

[We must leave each heart to know its own bitterness, as the old explorer retraces his steps to the tembé at Kwihara, there to hope and pray that good fortune may attend his companion of the last few months on his journey to the coast; while Stanley, duly impressed with the importance of that which he can reveal to the outer world, and laden with a responsibility which by this time can be fully comprehended, thrusts on through every difficulty.]

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## IN KHIVA.

BY

A. VAMBERY.

Arminius or Herman Vambery was born in Hungary in 1832, and was a noted orientalist and historian. He lived many years in Constantinople and in 1863–4 visited Persia, Khiva, Bokhara, Samarcand, Herat, and other parts of Central Asia, assuming the character of a traveling dervish (or a Persian monk vowed to proverty) in order to penetrate into those places where Western folk were not allowed to go. His life was in constant danger, but his experiences enabled him to write much that was new about the places he visited. He was an accomplished linguist and published among others a German-Turkish Dictionary. His career is a remarkable evidence of how much a man may do who makes himself master of a subject.

THE reader will easily imagine in what a state my spirits were when I found myself before the walls of Khiva, if he reflects on the risks to which any suspicion of my disguise would expose me, as soon as a first introduction should discover my European features. I was well aware that the khan of Khiva, whose cruelty was displeasing to the Tartars themselves, would, in case he felt any distrust, become far severer to me than

From "Travels in Central Asia." London.

the other Turkomans. I had heard that the khan was in the habit of at once making slaves of all strangers of doubtful character; that he had, not long before, so treated a Hindustani, who claimed to be of princely origin, and who was now, like the other slaves, employed in dragging along the artillery carriages. My nerves were all strung to the highest point, but I was not intimidated. I had, from constant risk, become inured to it. Death, the least serious result of my enterprise, had now been floating continually before my eyes for three months, and, instead of trembling, I considered how, on any pressing emergency, I might by some expedient get the better of the watchfulness of the superstitious tyrant. On the journey I had acquired exact information respecting all the distinguished Khivites who had been in Constantinople. They named to me oftenest a certain Shükrullah Bay, who had been in residence ten years at the court of the sultan. Of his person I had a half recollection, for I had seen him several times at the house of Ali Pasha, the present Minister of Foreign Affairs. This Shükrullah Bey, thought I, only knows Stamboul and its language, its manners and its great personages: whether he will or not, I must compel him to admit a previous knowledge of me; and as I can deceive, personating the Stambouli, the Stambouli himself, the ex-ambassador of the Khan of Khiva will never be able to disavow me, and must serve my purpose.

At the very entrance of the gate we were met by several pious Khivites, who handed up to us bread and dried fruits as we sat upon our camels. For years so numerous a troop of hadjis had not arrived in Khiva. All stared at us in astonishment, and the exclamations "Aman eszen geldinghiz" (welcome)! "Ha shah bazim! Ha arszlanim" (ah! my falcon, my lion)! resounded on all sides in our ears. On entering the bazar, Hadji Bilal intoned a telkin. My voice was heard above them all, and I felt real emotion when the people impressed their kisses upon my hands and feet — yes, upon the very rags which hung from me. In accordance with the custom of the

country, we dismounted at the caravanserai. This served also as a custom-house, where the new arrivals of men and merchandise are subjected to severe examination. The testimony of the chiefs of the caravans have, as is natural, the greatest weight in the balance. The functions of chief of the customs are filled in Khiva by the principal mehrem (a sort of chamberlain and confidant of the khan). Scarcely had this official addressed the ordinary questions to our kervanbashi, when the Afghan pressed forward and called out aloud, "We have brought to Khiva three interesting quadrupeds and a no less interesting biped." The first part of this pleasantry was, of course, applied to the buffaloes, animals not before seen in Khiva; but as the second part was pointed at me, it was no wonder that many eyes were immediately turned upon me, and amid the whispering it was not difficult to distinguish the words "djansiz"* (spy), "Frenghi," and "Urus" (Russian). I made an effort to prevent the blood rising to my cheeks, and was upon the point of withdrawing, when the mehrem ordered me to remain. He applied himself to my case, using exceedingly uncivil expressions. I was about to reply, when Hadji Salih, whose exterior inspired respect, came in, and, entirely ignorant of what had passed, represented me in the most flattering colors to my inquisitor, who, surprised, told me, smiling as he did so, to take a seat by his side. Hadji Salih made a sign to me to accept the invitation, but, assuming the air of one highly offended, and throwing an angry look upon the mehrem, I retired. My first step was to go to Shükrullah Bey, who, without filling any functions, occupied a cell at that time in the medresse of Mehemmed Emin-Khan, the finest edifice in Khiva. I announced myself to him as an effendi arrived from Stamboul, with the observation that I had made his acquaintance there, and had wished, in passing, to wait upon him. The arrival of an effendi in Khiva, an occurrence so unprecedented, occasioned the old man some surprise. He came forward himself to meet me, and his wonder in-

* From the Arabic word djasus (spy).

creased when he saw a mendicant, terribly disfigured and in rags, standing before him: not that this prevented him from admitting me. I had only interchanged a few words with him, in the dialect of Stamboul, when, with ever-increasing eagerness, he put question upon question concerning his numerous friends in the Turkish capital, and the recent doings and position of the Ottoman empire since the accession of the present sultan. As I before said, I was fully confident in the part I was playing. On his side, Shükrullah Bey could not contain himself for joy when I gave him news of his acquaintances there in detail. Still he felt not the less astonishment. "In God's name, effendi, what induced you to come to this fearful country, and to come to us, too, from that paradise on earth, from Stamboul?" Sighing, I exclaimed, "Ah! pir" (spiritual chief), laid one hand on my eyes, a sign of obedience, and the excellent old man, a Mussulman of tolerably good education, could not misapprehend my meaning, *i. e.*, that I belonged to some order of dervishes, and had been sent by my pir (chief of my order) upon a journey, which is a duty that every murid (disciple of an order of dervishes) must fulfill at the hazard of his life. My explanation rejoiced him; he but asked the name of the order. On my mentioning the Nakishbendi, he at once understood that Bokhara was the aim of my journey. He wished immediately to obtain for me quarters in the medresse before named but I mentioned at the same time my situation with respect to my companions. I then almost immediately withdrew, with the promise soon to repeat my visit.

On returning to the caravanserai, I was told that my fellow-travelers had already found lodgings in a tekkie, a sort of convent where traveling dervishes put up, called töshebaz.* I proceeded thither, and found that they had also reserved and got ready a cell for me. Scarcely was I again in their midst when they questioned me as to the

* So called from tört shahbaz, which means the four falcons or heroes, as the four kings are designated whose tomb is here, and who gave rise to the pious establishment.

cause of my delaying to rejoin them; all expressed their regret at my not having been present when the wretched Afghan, who had wished so to compromise me, had been obliged to beat a retreat, loaded with curses and reproaches, not only by them, but by the Khivites. "Very good," thought I; "the popular suspicion removed, it will be easy enough to deal with the khan, for he will be immediately informed of my arrival by Shükrullah Bey; and as the rulers of Khiva have ever evinced the greatest respect for the sultan, the present sovereign will certainly venture a step toward an effendi; nay, it is not impossible that the first man from Constantinople who has come to Kharezm (the political name of Khiva) may even be treated with particular distinction."

My anticipations did not deceive me. The next day there came a yasaul (officer of the court), bringing to me a small present from the khan, with the order that I should in the evening go to the ark (palace), "as the hazret" (a title of sovereignty in Central Asia, corresponding with our expression majesty) "attached great importance to receiving the blessing from a dervish born in the Holy Land." I promised compliance, betook myself an hour previously to Shükrullah Bey; and as he was desirous of being himself present at the interview, he accompanied me to the palace of the king, which was in his immediate vicinity, giving me, on the way, counsel as to the ceremonies to be observed in my interview. He also told me of the bad footing in which he himself stood with the mehter (a sort of minister of the Home Department), who feared him as a rival, and neglected nothing to do him an injury, and who, owing to my being introduced by him, would not, perhaps, give me the most friendly reception. As the kushbeghi and the elder brother of the king were commanding in the field against the Tchaudors, the mehter was provisionally the first official minister of the khan. Both usage and necessity forced me to begin by paying him my respects, for his office was in a hall in a forecourt at the very gate that leads directly to the khan's apartments.

As at this hour there was almost every day an arz (public audience), the principal entrance, as well as all the other chambers of the royal residence traversed by us, were crowded with petitioners of every class, sex, and age. They were attired in their ordinary dresses, and many women had even children in their arms, waiting to obtain a hearing; for no one is required to inscribe his name, and he who has managed to force his way first is first admitted. The crowd, however, gave way for us on all sides; and it was a source of great satisfaction to hear the women, while pointing to me, saying to one another, "Behold the dervish from Constantinople, who is to give his blessing to our khan. May God give ear to his words!"

I found the mehter, as I had been told, in a hall surrounded by his officers, who accompanied every word of their lord with approving smiles. It was easy to distinguish, by his brown complexion and his long thick beard falling down to his breast, that he was Sart (of Persian origin). His clumsy dress, and his great fur cap especially, suited his rough features admirably. As he saw me approach he spoke a few words laughingly to those around him. I went straight up, saluted him with a serious expression of countenance, and assumed at once the place of honor in the company, belonging of right to the dervishes. I uttered the usual prayers, and after all had added the Amen with the ordinary stroking of the beard, the customary civilities were interchanged with the mehter. The minister was desirous of showing his wit, and remarked that even dervishes in Constantinople were well educated, and spoke Arabic (although I had only made use of the Stambouli dialect). He proceeded to say that the hazret (his majesty) — and here every one rose from his seat — desired to see me, and that "he would be glad to hear that I had brought with me a few lines from the sultan or his ambassador in Teheran." Whereupon I observed that my journey had no secular object; that I wanted nothing from any one; but that, for my personal security, I had with me a firman, bearing at

the top the tugra (seal of the sultan). I then handed him my printed pass. On receiving this sign of paramount sovereignty, he kissed it reverently, rubbed it on his forehead, rose to place it in the hands of the khan, and, returning almost immediately, told me to step into the hall of audience.

I was preceded by Shükrullah, and was constrained to wait a few moments until the necessary preparations had been made; for, although I was announced as a dervish, my introducer had not neglected to draw attention to the fact that I was acquainted with all the pashas of distinction in Constantinople, and that it was desirable to leave upon me as imposing an impression as possible. After the lapse of a few moments my arms were held with every demonstration of respect by two yasaul. The curtain was rolled up, and I saw before me Seid Mehemmed Khan, Padishahi Kharezm, or, as he would be styled in ordinary prose, the Khan of Khiva, on a sort of elevation, or daïs, with his left arm supported upon a round silk velvet pillow, and his right holding a short golden sceptre.

According to the ceremonial prescribed, I raised my hands, being imitated in the act by the khan and the others present, recited a short sura from the Koran; then two allahumu sella, and a usual prayer beginning with the words "Allahumu rabbena," and concluding with a loud Amen and stroking of the beard. While the khan was still stroking his beard, each of the rest exclaimed "Kabul bolgay" (May thy prayer be heard)! I approached the sovereign, who extended his hands to me, and after we had duly executed our musafeha,* I retired a few paces and the ceremonial was at an end. The khan now began to question me respecting the object of my journey, and the impression made upon me by the desert, the Turkomans, and Khiva. I replied that I had suffered much, but that my sufferings were now richly rewarded by the sight of the hazrets djemal (beauty of his majesty). "I thank Allah," I said, "that I have been allowed

* Musafeha is the greeting prescribed by the Koran, accompanied by the reciprocal extension of the open hands.

to partake this high happiness, and discern in this special favor of kismet (fate) a good prognostic for my journey to come." Although I labored to make use of the Özbeg dialect instead of that of Stamboul, which was not understood here, the king was, nevertheless, obliged to have much translated for him. He asked me how long I proposed to stay, and if I was provided with the necessary journey expenses. I replied that I wished first to visit the Sunnite saints who repose in the soil of the khanat, and that I should then prepare for my journey farther on. With respect to my means, I said, "We dervishes do not trouble ourselves with such trifles. The holy nefes (breath) which my pir (chief of my order) had imparted to me for my journey can support me four or five days without any nourishment," and that I had no other wish than that God would permit his majesty to live a hundred and twenty years!

My words seemed to have given satisfaction, for his royal highness was pleased to order that I should be presented with twenty ducats and a stout ass. I declined the ducats with the remark that for a dervish it was a sin to keep money; thanked him, however, warmly for the second part of his most gracious favor, but begged permission to draw his attention to the holy commandment which prescribed a *white* ass for pilgrimages, and entreated him, therefore, to vouchsafe me such a one. I was on the point of withdrawing when the khan desired that, at least during my short stay in the capital, I should be his guest, and consent to take for my daily board two tenghe (about one franc and fifty centimes) from his haznadar. I thanked him heartily, concluded by giving my blessing, and withdrew. I hurried home through the waving crowds in the forecourt and the bazar, while all encountered me with the respectful " Selam aleïkum." When I found myself again alone within the four walls of my cell I drew a long breath, not a little pleased to find that the khan, who in appearance was so fearfully dissolute, and who presents in every feature of his countenance the real picture of an enervated, imbecile, and

savage tyrant, had behaved to me in a manner so unexceptionable; and that, so long as my time permitted, I could now traverse the khanat in all directions unmolested. During the whole evening I had floating before me the picture of the khan with his deep-set eyes, with his chin thinly covered with hair, his white lips, and trembling voice. "What a happy fatality," I repeated to myself, "that gloomy superstition often imposes limits to the might and blood-thirstiness of such tyrants!"

As I proposed making extensive excursions into the interior, I was desirous as far as possible to shorten my stay in the capital. What was most worth seeing might quickly be dispatched, had not repeated invitations of the khan, of the officials, and of the most distinguished of the mercantile community, robbed me of so much time. After it was known that I shared the favor of royalty, everybody wanted to have me as guest, and with me all the other hadjis. What a torture this to me, to have daily to accept six, seven, or eight invitations, and to comply with the usage by taking something in every house. My hair stands on end at the recollection how often I was forced to seat myself, between three and four o'clock in the morning, before sunrise, opposite a colossal dish of rice swimming in the fat of the sheep-tail, which I was to assail as if my stomach was empty. How, upon such occasions, I again longed for the dry unleavened bread of the desert, and how willingly I would have exchanged this deadly luxury for wholesome poverty!

In Central Asia it is the practice, even on the occasion of an ordinary visit, to set before you the desturkhan (a napkin of coarse linen and of a variety of colors, for the most part dirty). In this enough bread is generally placed for two persons, and the guest is to eat some pieces of this. "To be able to eat no more" is an expression regarded by the Central Asiatic as incredible, or, at least, as indicating low breeding. My pilgrim brethren always gave brilliant proofs of their *bon ton*. My only wonder is that they could support the heavy pilow, for upon one occasion I reckoned that each of them had devoured one

pound of fat from the tail of the sheep, two pounds of rice, without taking any account of bread, carrots, turnips, and radishes; and all this washed down, without any exaggeration, by from fifteen to twenty large soup-plates full of green tea. In such heroic feats I was naturally a coward; and it was the astonishment of every one that I, so well versed in books, should have acquired only a half acquaintance with the requisites of polite breeding!

Another source of torment to me not less considerable was that of the *beaux-esprits* of the ulemas of the city of Khiva. These gentlemen, who give the preference to Turkey and Constantinople beyond all other places, were desirous of receiving from me, the standard of Turkish Islamite learning, an explanation of many mesele (religious questions). Oh! how warm those thick-headed Özbegs made me, with their colossal turbans, when they opened a conversation concerning the prescriptions as to the mode of washing hands, feet, face, and occiput; and how a man should, in obedience to his holy religion, sit, walk, lie, and sleep, etc. The sultan (a recognized successor of Mohammed) and his grandees are accounted in Khiva the practical examples of all these important laws. His majesty the Emperor of Turkey is here designated as a Mussulman, whose turban is at least 50 ells in length, whose beard extends below his breast, and his robe to his toes. A man might place his life in jeopardy who should assert the fact that the sultan has head and beard shaved *à la* Fiesko, and clothes made for him at Paris by Dusetoye. I was often really sorry to be unable to give to these people, often persons very amiable, the satisfactory explanation they seemed to require; and how, indeed, could I have ventured upon such explanation, standing, as we do, in such direct contrast and opposition!

The töshebaz, or convent that gave us shelter, from the great reservoir of water and mosque which it incloses, was looked upon in the light of a public place: the court consequently swarmed always with visitors of both sexes. The Özbeg in his high round fur hat, great thick

boots of leather, walks about merely in a long shirt, in summer a favorite undress. This I myself adopted afterward, as I found it was not regarded as indecent, so long as the shirt retained its whiteness, even to appear with it in the bazaar. The women wear lofty globular turbans, consisting of from fifteen to twenty Russian kerchiefs. They are forced, striding along, in spite of all the overpowering heat, muffled in large gowns, and with their coarse boots, to drag to their houses heavy pitchers full of water. Ah! I see them now. Many a time one remains standing at my door, entreating for a little khaki shifa (health dust*), or a nefes (holy breath) for the real or feigned ill of which she complains. I have it not in my heart to refuse these poor creatures, many of whom bear a striking resemblance to the daughters of Germany. She cowers before my door: I touch, moving my lips at the same time as if in prayer, the suffering part of the body, and after having thrice breathed hard upon her, a deep sigh is uttered, and my part is done. Many in these cases persist that they receive an instantaneous alleviation of their malady!

What in Europe idlers seek in coffee-houses they find in Khiva in the courts of the mosques. These have in most cases a reservoir of water, and are shaded by the finest palms and elm-trees. Although at the beginning of June the heat was here unusually oppressive, I was nevertheless forced to keep my cell, although it was without windows, for immediately I issued forth and betook myself to the inviting shade, I was surrounded by a crowd, and plagued to death with the most stupid inquiries. One wanted religious instruction; another asked if the world offered elsewhere places as beautiful as Khiva; a third wished, once for all, to receive authentic information whether the great sultan really had his each day's dinner and supper forwarded to him from Mecca, and whether they passed to his palace from the Kaaba in

* This the pilgrims bring back with them from a house in Medina, affirmed to have been the Prophet's. It is used by the believers of the true faith as a medicine for many different maladies.

one minute. Ah! if the good Özbegs only knew how much Chateau Lafitte and Margot garnished the sovereign's table in the reign of Abdul Medjid!

Among the acquaintances made by me here, under the elm-trees, an interesting one resulted from my meeting with Hadji Ismael, represented to me as a Stambouli; and, indeed, so like one in speech, demeanor, and dress, that I was obliged to accept and tenderly embrace him as *my countryman!* Hadji Ismael had, it seems, passed twenty-five years in the Turkish capital, was intimate in many good houses, and asserted that he had seen me in such and such a house, and at such and such a time. He even insisted that it was no effort for him to remember my father, who was a mollah, he said, in Topkhane.* Far from charging him with impudent mendacity, I assured him, on the contrary, that he had himself left a good name behind him in Stamboul, and that every one awaited his return with impatience. According to his account, Hadji Ismael had carried on, on the shore of the Bosphorus, the business of tutor, proprietor of baths, leather-cutter, caligraphist, chemist, and, consequently, also of conjuror. In his native city they had a high opinion of him, particularly with reference to his last-named capacity; he had in his house several little apparatuses for distillation, and as he was in the habit of pressing out the oil from leaves, fruits, and other similar substances, it is easy to conceive that his countrymen applied to him for a variety of elixirs. . . .

In Khiva, in the meantime, my hadji business throve, both with me and my colleagues. In this place alone I collected fifteen ducats. The Khivan Özbeg, although but rough-hewn, is the finest character of Central Asia, and I may style my sojourn among his race here as most agreeable, were it not that the rivalry between the mehter and Shükrullah made me incur some danger, the former being always disposed, from hostility to my introducer, to do me harm; and as he could no longer question the genuineness of my Turkish character, he began to insinu-

* One of the quarters of Constantinople.

ate to the khan that I was only a sham dervish, probably sent upon some secret mission by the sultan of Bokhara.

Informed of the progress of this intrigue, I was not at all astonished, soon after my first audience with the khan, to receive a second invitation. The weather was intensely hot. I did not like to be disturbed in my hour of repose, but what I liked least of all was to be obliged to cross the square of the castle, whither the prisoners taken in the campaign against the Tchaudors had been sent, and where they were to be executed. The khan, who was numerously attended, told me that he had heard I was also versed in worldly sciences, and possessed a beautiful florid insha (style); he added that I must write him a few lines in Stambouli fashion, which he would like much to see. Knowing that this had been suggested by the mehter, who enjoyed himself the reputation of being a caligraphist, and had elicited the fact of my accomplishment from the hadjis, I took the proffered writing materials and wrote the following lines:

*Literally translated.*

"Most Majestic, Mighty, Dread King and Sovereign!

"Immersed in thy royal favor, the poorest and humblest of thy servants, keeping before his eyes (the Arabian proverb)* that 'all beautiful penmen are fools,' has until this day very little devoted himself to the study of caligraphy, and only because he calls to mind (a Persian proverb) )that 'every failing which pleases the king is a virtue,' does he venture to hand to him most submissively these lines."

The extravagant sublimity of the titles, which are, however, still in use in Constantinople, delighted the khan. The mehter was too stupid to understand my sarcasm. I was ordered to take a seat, and after having been offered tea and bread, the khan invited me to converse with him. The subject to-day was exclusively political. To remain true to my dervish character, I forced them to press every word out of me. The mehter watched each expression, wishing to see the confirmation of his suspicions. All his trouble was fruitless. The khan, after graciously dismissing me, ordered me to take the money for my daily support from the treasurer.

* Doctors male pingunt.

# A DASH FOR LASSA.

## THE FORBIDDEN LAND OF THE HOLY BOOKS.

BY

SVEN HEDIN.

Author of "Through Asia," etc.

To the famous Swedish traveler, Sven Hedin, we owe most of our recent knowledge of the vast country of Central Asia. As he tells us:—

"Travel in Asia is not a dance upon the dropping petals of the rose. Life, with the slow-moving caravans of its boundless deserts and untrodden mountain solitudes, cannot help being monotonous." But, it will be seen from the incident recounted here, there were happenings to break the monotony of the journey.

Not only is the country wild, and not only do its chief towns and cities lie in almost inaccessible places, but the climate is fierce and varied and the people have for long centuries resented intrusion from outsiders, backed up in this by the tenets of their religion. Hence, Tibet has always been looked upon as the "land of mystery" and only at long intervals have Europeans penetrated it. The number of those who have reached Lassa may be counted on the fingers of one hand and it is not, therefore, strange that the intrepid Swedish traveller did not succeed. Since his expedition, however, a British military expedition has entered the famous city and it may be that its mysteries will ere long be more fully revealed to the world.

Sven Hedin was born in Sweden in 1865. He travelled in Persia and Mesopotamia in 1885. Later he explored Khorassan and Turkestan and went across Asia from Orenburg to Pekin through the Gobi desert. His book on "Central Asia and Tibet" has been published in twelve languages, and "Through Asia" in nine.

AT the end of two hours, or rather more, the ranks again formed up around the white tent. The Tibetans appeared to be in desperate haste. They loosened their weapons. They mounted. Then a long black line of horsemen streamed out from amongst the tents and rode towards us at full gallop. It was not raining just at that moment, so there was nothing to prevent us from witnessing uninterrupted what was in truth a really magnificent spectacle. The Tibetans approached

From "Central Asia and Tibet Towards the Holy City of Lassa."

rapidly, keeping their horses steadily at the gallop. At first we only heard a confused hollow rumbling; but very soon we caught the swift thud, thud of the horses' hoofs beating the ground. It was as though a living avalanche were sweeping down upon us. A moment more and we should be annihilated. We held our weapons ready; but to see us standing there calmly waiting outside the tent, nobody would have suspected the terrible sense of uneasiness with which we were consumed.

On came the Tibetans in one long line stretching across the plain. In the middle rode the chief on a big handsome mule, though all the rest were on horseback. His staff of officials, military, civil, and priestly, who rode immediately behind him, were all dressed in their finest holiday attire. The wings consisted of soldiers armed to the teeth with gun, sword and lance, as though they were taking the field against a hostile tribe. We counted close upon 70 in all.

Then a small body detached themselves from the line, and quickening their pace, arrived two or three minutes in advance of the rest. They dismounted and saluted. One of them was my friend the interpreter, who simply announced that his Excellency Kamba Bomo was about to honor us with a visit. The great man himself arrived, and pulled up immediately in front of our tent. In a moment his attendants were out of the saddle, and had a carpet spread on the ground for their chief to step upon. He took his seat on a pile of cushions, which his servants held ready, and by his side sat Nanso Lama, a distinguished priest of Nakkchu.

I walked quietly forward and invited him into our tent. He at once entered, and after a little hesitation accepted the seat of honor I pointed to, a wet maize sack in the middle of our ill-smelling, almost mouldy, effects. His countenance expressed both cunning and sly humor; he blinked his eyes, and chuckled to himself. He was a man of about forty, little and pale, with a worn, tired look, though he was evidently delighted at having us safe in his toils. He knew it would be a great feather in his

cap when he reported his success to Lassa. His dress was tasteful and elegant, and he had evidently put it on specially for the occasion, for it was spotlessly clean. His servants removed his outer garb, consisting of a red Spanish cloak and a red bashlik or hood. He then stood forth arrayed in a suit of yellow silk, with wide arms, and a little blue Chinese skull-cap. His feet were encased in Mongolian boots of green velvet. In a word, he was magnificent. One of his men brought in pen, paper and inkhorn, and again the cross-examination began. Kamba Bombo was much less interested in us than in our headquarters camp and the strength of the caravan. He plied the pen himself, for he intended to send a detailed report to Lassa. Then he examined our belongings; but, strange to say, he never once expressed a wish to see the inside of our boxes; he was quite satisfied when we told him they contained our provisions. He seemed to have perfectly made up his mind with regard to myself, and even considered it superfluous to put any questions to me of a personal character. Shagdur, upon being questioned, adopted the tone of a field-marshal in giving his replies. He said he was a Russian subject and a Buriat, and as such had a perfect right to go to Lassa. The Russian authorities would regard it as an affront if we peaceful pilgrims were hindered from making the pilgrimage; nobody had any right to interfere with us.

But Kamba Bombo laughed, and said: "You need not think you can frighten me. I am going to do my duty. I have just had express orders from the Dalai Lama with regard to you, and I know better than you do what I have got to do. You will not go to Lassa. You will not go another day, not another step, towards Lassa. If you do you will lose your heads," and he drew his hand significantly across his throat. He added, that if he allowed us to go, he would lose his own life. "It doesn't matter the least who you are, or where you come from. Your actions are in the highest degree suspicious. You have slunk in by a back road, and must just go back to your headquarters."

We saw that we should have to obey; there was nothing else to be done. Shagdur then told him about our horses having been stolen. At first Kamba Bombo equivocated, and said he could not be answerable for what happened outside the boundaries of his own province. Shagdur replied, "Oh, so that country does not belong to you; perhaps then it belongs to Russia?" At this Kamba Bombo grew angry, and said that the whole country belonged to the Dalai Lama. Shagdur was afterwards immensely proud of the reply he made. The chief now rose, and taking Shagdur with him, went and sat down on the cushions outside. After a little while I was called out. Kamba Bombo was willing to procure two new horses, but I must pay for one of them. I simply laughed in his face, and, turning on my heel, walked back into the tent, saying, such presents would not do for us; it must be either two horses or none. Thereupon Kamba Bombo promised to give us next morning two others in place of the two we had lost.

On the whole he was very friendly and polite, not the least bit put out at having been disturbed, and compelled to ride over himself in this way. He was an excellent fellow to have to deal with: he knew his own mind and had a will of his own. Who I really was he never distinctly understood. I fancy, though, he must have believed that under the disguise of my threadbare Mongolian coat somebody out of the common was concealed, otherwise he would not have turned out with so much pomp and ceremony. The Tibetans are in constant communication with China, indeed they are nominally subject to that power, and China maintains a representative at Lassa, and a yamen or official residence in the vicinity of Potala, the temple palace of the Dalai Lama. There can be no doubt that the Lassa authorities had heard of the events which had recently occurred in China, and knew what stern vengeance had been exacted for the murder of Baron von Ketteler at Peking, and so considered it prudent not to injure a European.

Whilst this conversation was progressing, the other

Tibetans crowded round us, and kept making comments and observations. They carried their swords in handsome silver-mounted scabbards, decorated with corals and turquoises; silver gavos or cases for burkans, that is, little images of Buddha; bracelets and rosaries; and in the long plaits of their hair, various parti-colored ornaments — in a word, they were decked out in the handsomest finery they possessed. The more distinguished amongst them wore big white hats, with plumes in them; others had scarves wound round their heads, while the rank and file were bareheaded.

Shereb Lama was quite overpowered by all this grandeur. He lay prone on his knees with his gaze fixed immovably on the ground, and when the chief questioned him, which he did right sharply, was unable to meet Kambo Bomo's eye. His answers were short and hurried, as though he had no longer any secrets to conceal. What he actually said we did not know, for they spoke Tibetan; but afterwards he told us that Kamba Bombo sternly reproached him for having come with us, and said he ought to have known that no European would be tolerated in Lassa. His name was recorded in the black books of the temples, and he would never be permitted to set foot within the holy city again. If he attempted to enter it hidden amongst a pilgrim caravan, he must take the consequences. He had been faithless to his priestly dignity, and was a traitor.

Finally I proposed that I, with the help of our Lama and the interpreter, should write a letter to the Dalai Lama, who, if he really knew who we were, would, I asserted, be very pleased to receive us. But Kamba Bombo answered that it was quite unnecessary; he himself received orders every day direct from Lassa with regard to us, and for a man in his position it would be unseemly to offer advice to the Dalai Lama; it might lead to his dismissal, if not worse.

Thereupon he politely took his leave, swung himself up into his richly decorated saddle and rode away at a smart trot, followed by his large staff. By this it was

twilight, and the troop soon disappeared from our gaze, and with them my hope of setting eyes upon the Mecca of Lamaism. The stars twinkled brightly over the white temples of Lassa; not a breath of wind disturbed the peaceful serenity of the night, and only a dog barked occasionally in the far distance.

That evening we sat up a long time talking. Our Lama was downcast and taciturn; but Shagdur and I were in excellent spirits. It is true we had failed in our attempt to enter Lassa; but we had the satisfaction of knowing that we had done our very utmost. When you meet with insuperable obstacles, it is then time to turn back, and you need have no compunction at doing so. Still, it was odd that the Tibetans released us without a single rough word.

Early on the 10th August we bade the nearest of our guards fetch our horses and mules to the tent; for we had decided to start back that morning as soon as we could get away. But as no messenger appeared from Kamba Bombo, I resolved to go to him alone, although Shagdur and the Lama both warned me against doing so. They thought we ought to continue to stick together as we had done hitherto. But, disregarding their advice, I rode at a gentle pace between the marshes towards Kamba Bombo's white-tented village. When I got nearly half way, I was surrounded by a band of armed horsemen, probably a score in number. Without uttering a single word they formed up in front of me and behind me, and when about half a mile from their tents they stopped, formed a ring round me, dismounted, and signed to me to follow their example.

After waiting barely a quarter of an hour, the same cavalcade as yesterday rode out from amongst the tents and approached us at the gallop, Kamba Bombo, in his yellow robes, riding in the middle of them. A carpet and cushions were spread on the ground, and he invited me to take a seat by his side. The interpreter was present, and we had a good talk.

This method of receiving me on neutral ground was a

touch of etiquette which was as tactful as it was fully justified. The day before I had refused to accept Kamba Bombo's invitation, and he, no doubt, thought to himself: "I will show them they need not inconvenience themselves to come and visit me." He had likewise said: "You shall not take another step towards Lassa," and so he was come to prevent me. All my powers of persuasion were, however, not more successful now than they had been the day before. "I am not going to lose my head for you," he said. "So far as I myself am concerned, I don't care a pin whether you go to Lassa or not; but I have had my orders, and I am going to obey them." I then said to him, in a jesting tone: "You and I together could go there and back in a few days, and nobody be a bit the wiser." But he only laughed and shook his head, and cried: "Back, back with you! You must go back."

Then he blinked once, twice, three times, and uttered the single word "Sahib;" at the same time pointing south towards the Himalayas. It needed no interpreter to tell me what he meant. "You are an Englishman from India!" And say what I might, argue as I would, I could not get that conviction out of his head. Finding that he was not to be moved, I dropped the mask entirely, and admitted that I was a European, though not an Englishman; but that I came from a country in the north, a long way the other side of Russia; but he only laughed and kept repeating: "Sahib! Sahib!" Then I told him that I had with me two Buriat Cossacks and two Russian Cossacks, lent to me by the Russian Czar, and asked whether he believed that an Englishman would travel with Russian Cossacks, and whether he thought it likely that they would come from the north, when India lay to the south of Tibet. To this reasoning he replied in the same terms as before: "They are all Sahibs. If you have managed to get hold of a Mongolian Lama, you could easily secure a Buriat as well."

Two horses were now led forward, a dun one and a white one; these Kamba Bombo expressed himself as

willing to present to me. "Let two of your men get on their backs and take them for a gallop," I said. They did so; but the horses, which were as lean as scarecrows, stumbled and looked anything but first-rate animals. I then turned to Kamba Bombo and asked him how he, a rich and distinguished man, dared to offer to me, who was at least as distinguished as himself, two such wretched jades. I refused to accept them; he might keep them for his own cavalry. Instead of being offended at this candid observation, he commanded two other horses to be led forward. They were plump and in good condition, and after they had been duly tried, I agreed to accept them.

After that we all rode back to our tent. Kamba Bombo sat for a good while, and ate raisins as a horse eats oats, and was entertained with tea, tsamba, and tobacco. We were surrounded by the whole of his staff, who made a fine show in their fantastic attire, their women's hats and long plumes intermingling peacefully with their warlike lances and swords. They made a gaudy picture in the sunshine; and all laughed, as in duty bound, at the witticisms of their chief. We then exchanged some of our Chinese yambas for Tibetan silver money. Kambo Bombo had a pair of scales with him, and weighed very carefully the silver we handed over to him. After that we showed him our weapons, and they evidently made a great impression upon him. I told him it was not a bit of use his raking together so many soldiers; with their wretched muzzle-loading muskets we were not a bit afraid of them. If it came to hostilities, they should bear in mind that we could shoot down three dozen of them whilst they were loading. But he asserted that they did not want hostilities; they only wanted to keep unauthorized strangers outside the frontiers of their country.

Then I asked him straight out why he durst not come to my tent without being attended by an escort of 70 men; was he really so horribly afaid of me? "Not at all," he answered; "but I know you are a distinguished sahib, and I have been instructed from Lassa to show you the

same respect that we show to the highest dignitaries of our own country."

After waiting a long time, and waiting in vain, for a *deus ex machinâ* to open up for us the way to Lassa, I at length rose and gave orders to load up. This, with the help of the Tibetans, was accomplished in next to no time. Kamba Bombo then presented to me an escort of three officers and a score of men, who were to accompany us as far as the northern boundary of the province of Nakkchu. He assured me that as long as this escort was with us we need not trouble ourselves about anything; his men would look after our animals and provide us gratuitously with all the provisions we needed. And he wound up by making me a present of six sheep, a stock of milk-foods, and a number of bowls and dishes of fat. Then we said good-bye to this great chief, who had been at one and the same time so friendly and so inhospitable, and who had so inflexibly barred our way, and set off to return by the road we came. "Yes, my good Shagdur," I said — the fine fellow's courage and fidelity never wavered for a moment — "it is true we have not got into Lassa; but we have preserved our lives, for which we have every reason to be thankful."

After going some distance, I turned round in my saddle, and saw Kamba Bombo and his men poking and ferreting about the spot where our tent had stood. A few cigarette capsules and tag-ends of stearin candles would no doubt confirm them in the conviction that it was Europeans they had had to deal with. It was not until we had ridden for an hour or more that we fully understood how many men our escort consisted of, for first one turned back and left us, and then another, the last being our friend the interpreter, who importuned me incessantly for brandy.

Our escort really consisted of two officers, Solang Undy and Anna Tsering, with a junior officer and 14 soldiers, armed with sword, lance, and musket. Besides these there were also six other men, who were not soldiers, and whose duty it was to lead the pack-horses which carried

the commissariat, and drive before them a flock of half a score sheep. We rode at a good round pace, and I was greatly amused to observe how the Tibetans executed the orders given to them. They rode in front of us, they rode behind us, they rode on both sides of us, and never let us a moment out of their sight. If they could have done so, I am convinced they would have ridden above our heads and under our feet, so as to prevent us from climbing up to heaven or suddenly diving off to the nether world.

The day was well advanced, for we did not get started until two o'clock. Again and again the Tibetans stopped and suggested that we should encamp; evidently they did not mean to hurry themselves. But they were now under my command, and so, leaving our baggage animals behind us, I, Shagdur and the Lama rode on until we reached the vicinity of the lake of Tso-nekk. The Tibetans had promised to be answerable for our belongings, and sure enough they brought them up without grumbling. It was dusk when we halted. Our escort had with them two black tents, which they pitched one on each side of ours and close to it. As soon as the camp was quiet, the animals were turned loose to graze under the charge of a couple of the Tibetans. Then I went and had supper with Solang Undy and Anna Tsering. The latter was a young man, with an exceptionally pleasant and sympathetic face. Both were, like nearly all the Tibetans, beardless; and Anna Tsering, with his long, black, dishevelled hair, looked very like a girl.

For some time that evening their tents hummed like a beehive: it was the Tibetans reciting their evening prayers, awakening in our Lama melancholy recollections of the evenings he had spent in Lassa, where from every temple there used to go up at that hour of the day one voluminous swell of prayer. He feared he should never hear it again.

All night long it poured with rain; but except for that our rest was not disturbed. When we arose in the morning, there were all our animals ready waiting for us; but

everything was wet and heavy, and the ground greasy and slippery from the rain. Although it looked threatening all that day, the 11th August, it did not come down again. When the sun shone out, it was almost oppressively hot; at least it burned through my thin Chinese cap. Most of our escort wore nothing more than a coarse shirt, a sheepskin, and big boots. They had a very convenient and practical way of dealing with the second of these. When it was warm, they slipped out their right arm and pushed down the sheep-skin, so as to leave the arm and upper part of the body exposed; but when it turned cold they pulled it up over their shoulders again.

Their horses were small and plump, and had very long hair; but, in spite of their short, tripping steps, they got over the ground rapidly. Yet they stumbled a good many times and flung off their loads, or bolted with them, dragging them along the ground. As, however, the men were watchful and alert, and, as will readily be understood, accustomed to caravan travelling, things were soon put to rights again.

One of the chiefs had brought with him a long-haired yellow greyhound, with a blue ribbon and bells attached round its neck. Before we started I advised him to leave the animal behind; but he peremptorily insisted upon taking it. Before we got very far, however, Yollbars had a go at the brute, and mauled it fearfully. The greyhound, bleeding, limping, and howling, was then taken back in a string by one of the soldiers. The men of our escort stood terribly in awe of both our dogs. Even when they were mounted, they used to ride off directly Yollbars showed himself anywhere near, and when we pulled up at night they durst not dismount until we had tied up our dogs.

It was exceedingly annoying to have to retrace our own footsteps; but our Tibetans helped to shorten the road. I never grew tired of watching those wild men in their picturesque attire — their behaviour, their method of riding and managing their horses, of lighting their fires and cooking their food — everything they did, in

fact, both in camp and on the march was interesting. All except the officers were the very image of highwaymen. Whilst on the march several of them rolled up the long plaits of their hair, and tucked them under their broad-brimmed hats. Two old men, lamas, wore their hair short, and as they rode, incessantly turned their korlehs, or prayer-wheels, mumbling *On maneh padmeh hum!* without for one moment tiring, their voices rising and falling in a monotonous, sleepy sing-song. By this we had to some extent won the confidence of our escort, and they watched us less jealously. They chattered a good deal and were noisy, and evidently enjoyed the little trip. Shagdur was very often surrounded by a group of soldiers, jesting and joking with them right heartily. They laughed fit to split their sides at his attempts to speak their language.

Solang Undy wore over his shoulder a red cloth scarf with four big silver gavos sewn on the back of it, and carried at his belt his sabre, knife, steel and tinder-box, tobacco-pouch, pipe, and various other small articles, which rattled and jingled every time he moved. Amongst those I observed a small pair of nippers, with which he used carefully to pull out the hairs that dared to show themselves on his chin. His beardless face was seamed with wrinkles, making him look like an old woman. Carefully wrapping the plaits of his hair in a red handkerchief, he rolled the handkerchief round his head, and on the top of it balanced his felt hat with a big feather in it.

After riding three and a half hours, the Tibetans stopped and dismounted, asking whether we had any objection to a short rest for tea. My two fellow travellers voted for pushing on, but I preferred to let the Tibetans do as they wished, so that I might have an opportunity to study their habits. They said they had not had time to get their breakfast; and certainly their assertion was fully borne out by the honor they did to the dishes.

With their swords they carved three clods out of the soft, grassy soil, and upon them placed the pot in which

they boiled the water for their tea. They had with them a supply of dried argol, so that the fires were soon alight. Then they produced pieces of boiled mutton wrapped up in cloth, and prepared their tsamba of fat, butter, tea and small pieces of meat. As for us, we contented ourselves with sour milk. Whilst we were at breakfast our escort informed us that they were only ordered to accompany us as far as the river Garchu-sänghi, the boundary of the province of Nakkchu. After that they did not seem to care in the least where we went. We invited them to go with us all the way to our headquarters camp, but for that they had not the slightest inclination. They said they had only to obey orders; and it was easy to perceive that they fought very shy of our caravan, and of the force which they believed awaited us there. Thus in that particular part of the road which I may call the "robber-zone," we were to be left to look after ourselves. As it was now pitch dark at night, very different from the moonlight nights of our journey towards Lassa, we did not quite relish the prospect.

After all the rain we had had the ground was, if possible, still softer than before. The horses stumbled, floundered and stuck fast at almost every step. We seldom saw any of the occupants of the nomads' tents; our guards seemed purposely to avoid them, for they always encamped at some little distances away. Such provisions as they wanted were fetched by one or the other of them as they rode past.

That afternoon, when we stopped for good, the men of our escort procured from somewhere two additional tents, and were also joined by six more men. It was a quiet, beautiful evening, with the stars twinkling through a light veil of cloud. The camp-fires burned clear and bright under the gentle persuasion of the bellows; and the smoke from our own fire curled up through an oblong rift in the top of the tent. Altogether our camp that afternoon presented both a picturesque and an animated scene, especially as the Tibetans were full of talk and laughter.

Had Kamba Bombo been with us that night he would

have discovered excellent grist for his mill, for I produced my watch and mariner's compass. The Tibetans were completely mystified by the ticking of the watch, and never grew tired of listening to it. I told them it was a gavo, with a little live burkhan, *i. e.*, talisman, or image of Buddha, inside it. As soon as they were satisfied that my Verascope camera was not a revolver, nor any sort of mysterious infernal machine, they took no further notice of it. The camp that night was called Säri-kari.

In spite of the short marches they made, our Tibetans were early astir on the following morning. They were evidently enjoying the trip, and wanted to make it last as long as possible. In proportion as we approached the frontier of the province, our guards allowed us increasingly greater freedom. They often let us ride by ourselves a good bit behind their main force; though it was never very long before we perceived two or three mounted men following a long way in the rear. Next day we crossed the spacious valley where we first came in contact with the tea-caravan. Throughout the march I was put forcibly in mind of our merry sledge parties at home in the winter months. Every horse had a jingling bell round its neck, and the monotonous tinkle, tinkle had a very drowsy effect upon me. But just before we reached our former camp, No. LI., the Tibetans swung off to the right and entered a little glen called Digo, where they stopped amongst the high, luxuriant, aromatic grasses. We had only been in the saddle four and one-half hours, and I thought they were merely halting for tea again. But no, they had had enough for that day, for up went the tents. When I thought of our poor lean horses and mules I raised no objection. In fact, it was quite a relief, as well as a novelty, to be exempt from the responsibilities incident to the leadership of a caravan, and after our late fatigues, and the strain and anxiety we had undergone, the long night's rests did us a world of good. So long as we were favored with the escort, we could afford to take things quietly; after they left us we should be able to make as long marches as we liked.

The rest of the day was as beautiful as the spot we encamped in. We set the end of the tent that looked towards the north open, so as to let in the light breezes which wafted down the winding glen; but the other end we kept shut, for the sun was decidedly hot. I lay and slumbered for some time, partly listening to the babble of a little brook which mingled with the talk and laughter of the Tibetans, partly playing with the beads of my rosary, and watching the rods of sunshine, which filtered in through the top of the tent, as they glinted on their polished surfaces. The thermometer went up to 19°. 1 C. or 66° 4 Fahr. In fact, it was quite idyllic and summery, the last summer day we were destined to have.

The Tibetans were masters in the art of travelling comfortably and cheerfully. As soon as the order was given to halt, a troop of servants ran forward, and in a marvelously short space of time had the officers' tent up. Their saddles, bridles, saddle-bags, and other accoutrements were flung carelessly on the ground round about, and their muskets placed across the forked supports, so as to keep them off the damp ground. As the weather was so fine everybody sat outside, and with the interest of adepts studied the preparation of their meals, an art that Asiatics love to practice above all others. They were unsurpassed in getting argol alight, and with the help of the bellows, very clever in directing a tongue of flame against the side of their kettle, so that the water used to boil in next to no time. They prepared their tsamba in small wooden bowls, very like our Mongolian bowls. Some of them used to knead the mass with their right hand, and add powdered cheese to the concoction. When they ate meat, they held it with the left hand and shaved off small pieces with a knife held in their right hand — much as an English farm laborer eats his bread and bacon. Anna Tsering used for this purpose an English pen-knife "made in Germany," which came, he said, from Ladak.

I was very anxious to secure specimens of several parts of their equipment and outfit, but they asked such

exorbitant prices for them I could not deal. For a sword in a silver-mounted scabbard, studded with turquoises and coral, they demanded 50 liang (about $42), although it was not really worth more than 11 liang. For a prayer-mill they demanded 100 liang. When I enquired about their muskets and lances, they told me they belonged to the Government, and they durst not sell them, at any price. We spent a good many hours in their tents; but they never once put foot inside ours. I suppose Kamba Bombo had forbidden them to do so, for I had said I wished to be left as far as possible undisturbed.

At nine o'clock that evening the thermometer registered 9° 1 C. or 48° 4 Fahr., and at seven o'clock next morning 7° 8 C., or 46° 0 Fahr. That day, the 13th August, there were only eight soldiers left, and they came in from the north, each leading a spare horse. They had probably been to reconnoitre, and conferred a long time with their chiefs before we got started. We now crossed the Sachu-sangpo again; it carried only one-fourth the volume it did before. This time we forded it without the slightest mishap, for the Tibetans knew exactly where the ford was; still, in the deepest places the water came up to the horses' girths. The men of our escort pulled off their boots before entering the river, and put them on again when they were safely across.

A short distance from the right bank we came to fresh springs and good grazing, which we somehow missed on the outward journey, and there we put up for the night. We had thus done three out of the nine stages, although these three had taken us four days. Next morning the Tibetans were to leave us; but we were now on such friendly terms with them that we did not at all like the idea of parting from them; we felt we should actually miss them. We tried to persuade them to go a little bit farther; but they had done their duty, and would do no more. I threatened that, after they were gone, I would stay a little more time beside the Sachu-sangpo, and then turn back, and once more make for Lassa. "Just as you please," they answered. "We were ordered to conduct you to the frontier, and we have done so."

# IN AND ABOUT JERUSALEM AND THE DEAD SEA.

BY

F. W. Lynch, U. S. N.

Commander F. W. Lynch was born in Virginia in 1801 and died in Baltimore in 1865. He commanded the Exploring Expedition described in the volume from which the following description is abridged, in 1848. Later he was in the Confederate service during the Civil War.

For the more complete appreciation of this paper the reader should provide himself with a Bible — a Concordance and a map of Palestine — by referring to these he will greatly enhance the interest and widen the information he will gain from reading it.

SOON after noon, we passed the last encampment of black tents, and turning aside from the line of march, I rode to the summit of a hill on the left, and beheld the Holy City, on its elevated site at the head of the ravine; its site, from that view, seemed, in isolated grandeur, to be in admirable keeping with the sublimity of its associations. A lofty mountain, sloping to the south, and precipitous on the east and west, has a yawning natural fosse on those three sides, worn by the torrents of ages. The deep vale of the son of Hinnom; the profound chasm of the valley of Jehoshaphat, unite at the south-east angle of the base to form the Wady en Nar, the ravine of fire, down which, in the rainy season, the Kidron precipitates its swollen flood into the sea below.

Mellowed by time, and yet further softened by the intervening distance, the massive walls, with their towers and bastions, looked beautiful yet imposing in the golden sunlight; and above them, the only thing within their

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compass visible from that point, rose the glittering dome of the mosque of Omar, crowning Mount Moriah, on the site of the Holy Temple. On the other side of the chasm, commanding the city and the surrounding hills, is the Mount of Olives, its slopes darkened with the foliage of olive-trees, and on its very summit the former Church of the Ascension, now converted into a mosque. . . .

The ravine widened as we approached Jerusalem; fields of yellow grain, orchards of olives and figs, and some apricot-trees, covered all the land in sight capable of cultivation; but not a tree, nor a bush, on the barren hill-sides. The young figs, from the size of a currant to a plum, were shooting from the extremities of the branches, while the leaf-buds were just bursting. Indeed, the fruit of the fig appears before the leaves are formed, and thus, when our Saviour saw a fig-tree in leaf, he had, humanly speaking, reason to expect to find fruit upon it.

Although the mountain-sides were barren, there were vestiges of terraces on nearly all of them. On the slope of one there were twenty-four, which accounts for the redundant population this country once supported.

Ascending the valley, which, at every step, presented more and more an increasing luxuriance of vegetation, the dark hue of the olive, with its dull, white blossoms, relieved by the light, rich green of the apricot and the fig, and an occasional pomegranate, thickly studded with its scarlet flowers, we came to En Rogel, the Well of Job, or of Nehemiah (where the fire of the altar was recovered), with cool, delicious water, 118 feet deep, and a small, arched, stone building over it.

On our right, was the Mount of Offence, where Solomon worshipped Ashtaroth: before us, in the rising slope of the valley of Jehoshaphat, had been the kings' gardens in the palmy days of Jerusalem: a little above, and farther to the west, were the pool of Siloam and the fountain of the Virgin: on the opposite side of the chasm was the village of Siloam, where, it is said, Solomon kept his strange wives; and, below it, the great Jewish burial-ground, tessellated with the flat surfaces of grave-stones;

and, near by, the tombs of Absalom, Zacharias, and Jehoshaphat; and, above and beyond, and more dear in its associations than all, the garden of Gethsemane.

We here turned to the left, up the valley of the son of Hinnom, where Saul was anointed king; and, passing a tree on the right, which, according to tradition, indicates the spot where Isaiah was sawn asunder; and by a cave in which it is asserted that the apostles concealed themselves when they forsook their Master; and under the Aceldama, bought with the price of blood; and near the pool in the garden of Urias, where, from his palace, the king saw Bathsheba bathing; we traveled slowly along the skirts of Mount Zion, near the summit of which towered a mosque, above the tomb of David.

Following the curve of the vale of Hinnom, the Gehenna of the Old Testament, which rounds gradually to the north, with the Hill of Evil Counsel* on our left, we proceeded to the lower pool of Gihon, where, at 5 P. M., we were compelled to halt.

We pitched our tents upon a terrace, just above where the aqueduct crosses from Solomon's pool, with Zion gate immediately over us, and, a quarter of a mile below the tower of Hippacus and the Jaffa gate. In a line with us, above the Jaffa gate, was the upper pool of Gihon, with a number of Turkish tombs near it. On the opposite, or western side of the ravine, were old, gray, barren cliffs, with excavated tombs and caverns. The lower pool, beneath the camp, is formed by two huge, thick walls across the chasm. The aqueduct is led along the upper edge of the lower one; and the surface of the wall serves as a bridge, over which passes the road to Bethlehem — the one traversed by our Saviour, on his first visit to Jerusalem.

Passing a large tomb which stands conspicuous to the north, we camped a little off the Jaffa road, beside an olive-tree, about a mile and a half distant from the city;

* So called, from the tradition that on it Caiaphas dwelt when he counselled with the Jews.

and as far south-west from the reputed place where the Empress Helena was buried, and immediately west of the site most probably occupied by the besieging camp of the Roman army under Titus. There were many fields of grain around us, occasionally separated by low walls of uncut and uncemented stone. There were few trees, and the mountains, from their summits two-thirds down, were masses of brown rock without soil and unrelieved by verdure. South-west from us, about a mile distant, was a large building, its towers just visible over an intervening ridge. It was the Greek convent of the Holy Cross, where, we were told, "is the earth that nourished the root, that bore the tree, that yielded the timber, that made the cross."

It is from this quarter that the appearance of Jerusalem has been usually described. Looking hence upon the city, but little above a level, it is certainly less grand and imposing than from the gorge of the valley to the south-east, where it towers majestically above the spectator. Yet, beheld even from this point, there is no other city in the world which can compare with it in position. It does not, like other cities, present an indefinite mass of buildings, which must be viewed in detail before the eye can be gratified; but, with only its dome-roofs swelling above the time-stained and lofty walls, Jerusalem sits enthroned, a queen in the midst of an empire of desolation. Apart from its associations, we look upon it in admiration; but, connected with them, the mind is filled with reverential awe, as it recalls the wondrous events that have occurred within and around it.

The city is nearly in the form of a parallelogram, about three-fourths of a mile long, from east to west, and half a mile broad, from north to south. The walls are lofty, protected by an artificial fosse on the north, and the deep ravines of Jehoshaphat, of Gihon, and the Son of Hinnom, on the east, south, and west. There are now but four gates to the city. The Jaffa gate, the fish-gate of the New Testament, on the west; the Damascus gate, opening on the great northern road, along which our Saviour

traveled, when, at twelve years of age, he came up with his mother and kindred; the gate of St. Stephen, on the east, near the spot where the first Christian martyr fell, and overlooking the valley of Jehoshaphat; and the Zion gate, to the south, on the crest of the mount. Immediately within the last, are the habitations of the lepers.

The following account of his first day in Jerusalem is from the diary of the youngest member of the party, who was sent up from Ain Jidy in advance of the camp. I give it as the unvarnished recital of one who simply relates what he saw.

"The Via Dolorosa, or Sorrowful Way, first arrested our attention, and our guide pointed out the spot where our Saviour fell under the burden of the cross. A little farther on, we had a partial view of the mosque of Omar, above the high walls by which it is surrounded. While we gazed on it, a crowd of Abyssinian pilgrims called out to us with such fierce expressions of fanatic rage that our hands instinctively grasped our weapons. The movement had its effect, and after indulging our curiosity, we passed on unmolested.

"Next to Mecca, Jerusalem is the most holy place of Mohammedan pilgrimage, and throughout the year, the mosque of Omar and its court are crowded with turbanned worshippers. This mosque, built upon the site of the Holy Temple, is the great shrine of their devotions. It is strictly guarded against all intruders, and there is a superstitious Moslem belief that if a Christian were to gain access to it, Allah would assent to whatever he might please to ask, and they take it for granted that his first prayer would be for the subversion of the religion of the Prophet.

"In one of the streets we came to a low gate, passing through which and descending a long flight of stairs, we entered upon an open court in front of the church of the Holy Sepulchre, an ancient and venerable building. Scattered about the court were motley groups of Jew pedlers, Turks, beggars, and Christian pilgrims. The appearance

of a poor cripple excited my compassion, and I gave him a piastre; but the consequences were fearful. The war-cry of the Syrian pauper, "backshish! backshish!" instantly resounded from all quarters, and we were hemmed in, pressed, and swayed to and fro by the rabble. Our cicerone plied his stick vigorously in our defence, and it truly seemed to be gifted with miraculous powers, for the blind saw, and the lame walked, and amid their imprecations upon our Christian heads we entered the church

"Just within the door, seated on a raised divan, two sedate old Moslems were regaling themselves with miniature cups of coffee and the everlasting chiboque. Immediately in front of the entrance is the stone of unction, upon which, according to tradition, the body of our Lord was anointed. It is a plain slab of Jerusalem marble, slightly elevated above the floor of the church, and enclosed by a low railing. The pilgrims, in their pious fervour, crowding forward to kiss it, prevented our near approach.

"Turning to the left, we saw in the centre of the main body of the church a small oblong building, which contains the sepulchre. There were different processions crossing and recrossing each other with slow and measured pace, each pilgrim with a taper in his hand, and the numerous choirs, in various languages, were chanting aloud the service of the day. The lights, the noise, and the moving crowd had an effect for which the mind was not prepared, and with far less awe than the sanctity of the place is calculated to inspire, we entered the sepulchre. In the middle of the first apartment, for it is divided into two, is a stone, upon which the angel was seated when he informed the two Marys of the resurrection. This room is about eight feet square, and beautifully ornamented. From this we crept through a narrow aperture into the inner apartment, against the north side of which is the sepulchre in the form of a low altar. It is about the same size as the first, and between the sepulchre and the southern wall, there is barely space to kneel. It was brilliantly lighted by rich and costly lamps.

"From the sepulchre we were led to see the pillar of flagellation, visible through a hole in the wall, but we did not credit the pious imposition. Thence, we ascended to the altar of Calvary, with three holes beneath it, where were planted the crosses upon which the Saviour and the two thieves were crucified. The holes are cut through beautifully polished marble.* Near by is a fissure in the limestone rock, caused, it is alleged, by the earthquake which closed the sad drama of the crucifixion. This rent is certainly not an artificial one. Before leaving the church, we visited the tomb of Godfrey of Bouillon, and the place where the true cross, it is said, was found by the Empress Helena.

"We next determined to visit a spot respecting the identity of which even the mind of the most skeptical can have no room for doubt. Passing through the Damascus gate, we skirted the northern wall, and descending into the valley of Jehoshaphat, and crossing the bridge over the dry bed of the Kidron, we commenced the ascent of the Mount of Olives. We soon reached the summit, but the scorching heat of a Syrian sun did not permit us to enjoy long the magnificent view it afforded. Parts of the Dead Sea were visible, and looking down upon it, we felt proud in being able to say that we were the first thoroughly to explore this sea, which has for ages kept its mysteries buried in the deep bosom of its sullen waters.

"On our return, we stopped at the garden of Gethsemane, which is held by the Latins, who have enclosed it with a wall. After repeatedly knocking at the gate, we were about to come away, when it was opened by a garrulous old Spaniard, whose visage was as gnarled as the trees we now saw before us. The garden consists of eight enormous olive-trees, their venerable appearance truly typical of old age; and there can scarcely be a reasonable doubt that this is, indeed, the very place where the Saviour wept and prayed.

* The writer was not aware that the surface of the natural rock had been cut away, and marble placed upon it.

## THE GARDEN OF GETHSEMANE

Gethsemane means a very fat valley—a valley of oil—doubtless so called because of the olive trees which grew there.

"And they came to a place which was named Gethsemane; and He saith to His disciples, "Set ye here while I shall pray."—Mark xiv. 32.

"Crossing the valley of Jehoshaphat, and ascending the slope of Mount Moriah, we passed by the Golden Gate, now walled up by the Turks. Why it is called 'golden' I am unable to say, unless from its rich and elaborate sculpture.

"We next came to the fountain of the Virgin, which flows through a subterranean passage into the pool of Siloam, and is thence distributed along the slope of the valley. The pool is near the foot of the mount, and is a deep oblong pit, with fragments of columns in the centre. There are steps leading down to it on the left side, and the water is muddy and shallow. Here Christ restored the blind man to sight.

"Re-entering the city through the Jaffa gate, our cicerone declared 'by the body of Bacchus' that he would show us the greatest sight in the Holy City. It was the Armenian convent near by. We entered through the portal, and were ushered into an antechamber by a sour looking old monk, where, in the midst of a crowd of camel-drivers, we waited for permission from the patriarch to see the riches of the convent. We were first shown the portraits of all preceding patriarchs, now canonized as saints in their calendar; while that of the present one was the most gorgeously framed — par excellence, the greatest saint of them all. Persons well versed in the art of discolouring canvass had painted these miserable daubs, which, taking the portrait of the present patriarch as a fair criterion, bore not the slightest resemblance to their originals.

"We then entered the chapel, the *chef-d'œuvre* of this costly building. The most tasteful ornaments were the doors, made of tortoise-shell and inlaid with mother-of-pearl. The walls were of mosaic, representing saints and devils engaged in most furious combats; but unfortunately, although our cicerone zealously endeavoured to point out which were the saints and which the devils, we often fell into a mistake respecting them. We were shown throughout the convent, which is constructed in the well-known Saracenic style of architecture; and the

patriarch long detained us with an account of the improvements he intended to make. . . .

Eight venerable trees, isolated from the smaller and less imposing ones which skirt the base of the Mount of Olives, form a consecrated grove. High above, on either hand, towers a lofty mountain, with the deep, yawning chasm of Jehoshaphat between them. Crowning one of them is Jerusalem, a living city; on the slope of the other is the great Jewish cemetery, a city of the dead. Each tree in this grove, cankered, and gnarled, and furrowed by age, yet beautiful and impressive in its decay, is a living monument of the affecting scenes that have taken place beneath and around it. The olive perpetuates itself, and from the root of the dying parent stem, the young tree springs into existence. These trees are accounted 1000 years old. Under those of the preceding growth, therefore, the Saviour was wont to rest; and one of the present may mark the very spot where he knelt, and prayed, and wept. No caviling doubts can find entrance here. The geographical boundaries are too distinct and clear for an instant's hesitation. Here the Christian, forgetful of the present, and absorbed in the past, can resign himself to sad yet soothing meditation. The few purple and crimson flowers, growing about the roots of the trees, will give him ample food for contemplation, for they tell of the suffering life and ensanguined death of the Redeemer.

On the same slope and a little below Gethsemane, facing the city, are the reputed tombs of Absalom, Zachariah, St. James, and Jehoshaphat, the last giving its name to the valley. Some of them are hewn bodily from the rock, and the whole form a remarkable group. That of Absalom in particular, from its peculiar tint, as well as from its style of architecture, reminded us of the descriptions of the sepulchral monuments of Petra. It is eight feet square, surmounted by a rounded pyramid, and there are six semi-columns to each face, which are of the same mass with the body of the sepulchre.

The tomb of Zachariah is also hewn square from the

rock, and its four sides form a pyramid. The tomb of Jehoshaphat has a handsomely carved door; and a portico with four columns indicates the sepulchre where St. James, the apostle, concealed himself.

It was in the valley of Jehoshaphat that Melchisedec, king of Salem, met Abraham on his return from defeating the five kings in the vale of Siddim. In the depths of this ravine Moloch was worshipped, beneath the temple of the Most High, which crowned the summit of Mount Moriah.

In the village of Siloam, the scene of Solomon's apostasy, the living have ejected the dead, and there are as many dwelling in tombs as in houses. Beneath it, at the base of the Mount of Offence, is the great burial-ground, the desired final resting-place of the Jews all over the world. The flat stones, rudely sculptured with Hebrew characters, lie, as the tenants beneath were laid, with their faces towards heaven. In the village above it and in the city over against it, the silence is almost as death-like as in the grave-yard itself. Here the voice of hilarity or the hum of social intercourse is never heard, and when man meets his fellow there is no social greeting. The air here never vibrates with the melodious voice of woman, the nearest approach to a celestial sound; but, shrouded from head to foot, she flits about, abashed and shrinking like some guilty thing. This profound silence is in keeping with the scene. Along the slope of the hill, above the village, the Master, on his way to Bethany, was wont to teach his followers the sublime truths of the gospel. On its acclivity, a little more to the north, he wept for the fate of Jerusalem. In the garden below, he was betrayed, and within those city walls he was crucified. Everything is calculated to inspire with awe, and it is fitting that, except in prayer, the human voice should not disturb these sepulchral solitudes.

From the slope of the Mount of Olives projects a rock, pointed out by tradition as the one whereon the Saviour sat when he predicted and wept over the fate of Jerusa-

alem. It is further alleged that upon this spot Titus pitched his camp when besieging the city. Neither the prediction nor its accomplishment required such a coincidence to make it impressive. The main camp of the besiegers was north of the city, but as the sixth legion was posted on the Mount of Olives, the tradition may not be wholly erroneous.

A little higher, were some grotto-like excavations, hypothetically called the Tombs of the Prophets; and above them were some arches, under which, it is said, the Apostles composed the creed. Yet above, the spot is pointed out where the Messiah taught his disciples the Lord's Prayer.

On the summit of the mount are many wheat fields, and it is crowned with a paltry village, a small mosque, and the ruined church of the Ascension. In the naked rock, which is the floor of the mosque, an indentation is shown as the foot-print of the Messiah, when he ascended to heaven. Apart from the sites of the Temple, of Calvary, and of the Holy Sepulchre, the assigned localities within the city walls, such as the Arch of the Ecce Homo, and the house of the rich man before whose gate Lazarus lay, are unworthy of credit. But those without the walls, like the three first-named within them, are geographically defined, and of imperishable materials. While one, therefore, may not be convinced with regard to all, he feels that the traditions respecting them are not wholly improbable.

From the summit, the view is magnificent. On the one hand lay Jerusalem, with its yellow walls, its towers, its churches, its dome-roof houses, and its hills and valleys, covered with orchards and fields of green and golden grain, while beneath, distinct and near, the mosque of Omar, the Harem (the Sacred), lay exposed to our infidel gaze, with its verdant carpet and groves of cypress, beneath whose holy shade none but the faithful can seek repose. On the other hand was the valley of Jordan, a barren plain, with a line of verdure marking the course of the sacred river, until it was lost in an expanse of sluggish water, which we recognised as the familiar scene of

our recent labours. The rays of the descending sun shone full upon the Arabian shore, and we could see the castle of Kerak, perched high up in the country of Moab, and the black chasm of Zerka, through which flows the hot and sulphureous stream of Callirohoe.

No other spot in the world commands a view so desolate, and, at the same time, so interesting and impressive. The yawning ravine of Jehoshaphat, immediately beneath, was verdant with vegetation, which became less and less luxuriant, until, a few miles below, it was lost in a huge torrent bed, its sides bare precipitous rock, and its bed covered with boulders, whitened with saline deposit, and calcined by the heat of the Syrian sun. Beyond it, south, stretched the desert of Judea; and to the north was the continuous chain of this almost barren mountain. These mountains were not always thus barren and unproductive. The remains of terraces yet upon their slopes, prove that this country, now almost depopulated, once maintained a numerous and industrious people.

North of Gethsemane, nearer the bed of the ravine and the one-arched bridge which spans it, is a subterranean church, in a grotto reputed to contain the tomb of the Virgin Mary.

Returning from the Mount of Olives, we passed along the hill of Zion, and made another circuit of the city.

A little below the gate of St. Stephen is the pool of Bethesda, where our Saviour healed the paralytic. It is now dry, and partly filled with rubbish.

Yet farther south, in the face of the eastern wall, near the court of the mosque of Omar, is the Golden gate, now built up. Through this gate, it is supposed, the Messiah entered in triumph on the Sunday preceding his crucifixion.

Some distance down, is the Fountain of the Virgin; and yet farther below, the pool of Siloam, which has been mentioned before. The water, which is hard and unpalatable to the taste, has no regular current, but ebbs and flows at intervals of a few minutes.

North of the city, on the margin of the Damascus road,

was a picturesque scene — hundreds of Jews, enjoying the fresh air, seated under enormous olive-trees — the women all in white shrouds, the men in various costumes — some with broad-brimmed black hats, and many with fur caps. There were also many Turks and Christians abroad. The Jewesses, while they enveloped their figures in loose and uncomely robes, allowed their faces to be seen; and the Christian and the Turkish female exhibited, the one, perhaps, too much, the other, nothing whatever of her person and attire. There was also a marriage-procession, which was more funereal than festive. The women, as usual, clothed all in white, like so many spectres, chaunted unintelligibly, in a low, monotonous, wailing tone; while some, apparently the most antique, for they tottered most, closed each bar with a scream like a diapason. The least natural and the most pompous feature of the scene was the foreign consuls, promenading with their families, preceded by Janissaries, with silver-mounted batons, stalking solemnly along, like so many drum-majors of a marching regiment. As the sun sank behind the western hills, the pedestrians walked faster, and the sitters gathered themselves up and hastened within the walls.

The present walls of the city were rebuilt in the 16th century, and vary from thirty to sixty or seventy feet in height, according to the inequalities of the ground. They are about ten feet thick at the base, narrowing to the top. The stones are evidently of different eras, extending back to the period of the Roman sway, if not to the time when Judea was an independent kingdom. Some massive pieces near the south-eastern angle bear marks of great antiquity. From a projecting one, the Turks have a prediction that Mohammed, their Prophet, will judge his followers.

On the third day after our arrival, we went to Bethlehem, two hours distant. Going out to the Jaffa gate, and obliquely descending the western flank of Mount Zion, he crossed the valley of the Son of Hinnom (Wady Gehenna, or valley of Hell), by the wall of the lower pool of Gihon.

The road then turned southwardly, and ran mostly parallel with the aqueduct from Solomon's pools. This aqueduct consists of stones hollowed into cylinders, well cemented at the joints, and supported upon walls or terraces of rock or earth, and mostly concealed from sight. Here and there, a more than usual luxuriance of vegetation indicated places where water was drawn from it to irrigate the olive orchards which, for much of the way, abounded on our left; and occasionally, a stone drawn aside disclosed a fracture in the trough beneath, where the traveler might quench his thirst.

We soon came to the well of the Magi, assigned by tradition as the spot where the star reappeared to the wise men from the east. The country on our left was here broken and rough, and on the right was the plain of Rephaim, with the convent of John the Baptist, erected on the spot where the great precursor was born, and the grotto where the Virgin Mary pronounced that sublime hymn, beginning "My soul doth magnify the Lord." We next came to the tomb of Rachel, in the plain of Ramah — a modern Turkish building, but the locality of which is believed to be correctly assigned. It is a small building, with two apartments, the one over the tomb being surmounted by a dome. On the right was the wilderness of St. John, wherein the Baptist practised his austerities. In that direction, too, is the valley of Elah, where David slew the giant; and in the valley before us, it is said the army of Sennacherib the Assyrian was encamped, when

"The angel of death spread his wings on the blast."

Ascending the hill from the tomb, and for the second time during the ride recognizing the Dead Sea through gorges in the mountains, we passed some extensive olive orchards, and after turning aside to the left to look at a nearly dry cistern called David's Well, and admiring the luxuriant groves of olives and figs, and the many vineyards which beautify the head of the ravine of Ta'âmirah, we entered Bethlehem, the "city of King David," and the birthplace of the Redeemer. . . .

To the east of Bethlehem is the hill where the shepherds heard the annunciation of the birth of the Messiah; and in the plain below, the field where Ruth gleaned after the reapers. The country around was luxuriant with vegetation and the yellow grain, even as we looked, was falling beneath the sickle. Variegated flint, chalk and limestone, without fossils, cropped out occasionally on the hill-sides; but along the lower slopes, and in the bottom of the valley, were continuous groves, with a verdant carpet beneath them. It was the most rural and the loveliest spot we had seen in Palestine.

On the Dead Sea.

At 8.30, started again and steered E. S. E., sounding every five minutes, the depth from one to one and three-quarter fathoms; white and black slime and mud. A swallow flew by us. At 8.52, stopped to take compass bearings. Seetzen saw this salt mountain in 1806, and says that he never before beheld one so torn and riven; but neither Costigan nor Molyneaux, who were in boats, came farther south on the sea than the peninsula. With regard to this part, therefore, which most probably covers the guilty cities —

> "We are the first
> That ever burst
> Into this silent sea."

At 9, the water shoaling, hauled more off shore. Soon after, to our astonishment, we saw on the eastern side of Usdum, one-third the distance from its north extreme, a lofty, round pillar, standing apparently detached from the general mass, at the head of a deep, narrow, and abrupt chasm. We immediately pulled in for the shore, and Dr. Anderson and I went up and examined it. The beach was a soft, slimy mud encrusted with salt, and a short distance from the water, covered with saline fragments and flakes of bitumen. We found the pillar to be of solid salt, capped with carbonate of lime, cylindrical in front and pyramidal behind. The upper or rounded part is about forty feet high, resting on a kind of oval pedestal,

from forty to sixty feet above the level of the sea. It slightly decreases in size upwards, crumbles at the top, and is one entire mass of crystallization. A prop, or buttress, connects it with the mountain behind, and the whole is covered with debris of a light stone color. Its peculiar shape is doubtless attributable to the action of the winter rains. The Arabs had told us in vague terms that there was to be found a pillar somewhere upon the shores of the sea; but their statements in all other respects had proved so unsatisfactory, that we could place no reliance upon them.*

At 10.10, returned to the boat with large specimens. The shore was soft and very yielding for a great distance; the boats could not get within 200 yards of the beach, and our foot-prints made on landing, were, when we returned, incrusted with salt.

Some of the Arabs, when they came up, brought a species of melon they had gathered near the north spit of Usdum. It was oblong, ribbed, of a dark green color, much resembling a cantelope. When cut, the meat and seeds bore the same resemblance to that fruit, but were excessively bitter to the taste. A mouthful of quinine could not have been more distasteful, or adhered longer and more tenaciously to the reluctant palate.

Intending to examine the south end of the sea, and then proceed over to the eastern shore in the hope of finding water, we discharged all our Arabs but one, and sharing our small store of water with them, and giving them provisions, we started again at 10.30, and steered south.

* A similar pillar is mentioned by Josephus, who expresses the belief of its being the identical one into which Lot's wife was transformed. His words are, "But Lot's wife continually turning back to view the city as she went from it, and being too nicely inquisitive what would become of it, although God had forbidden her so to do, was changed into a pillar of salt, for I have seen it, and it remains at this day."—1 *Josephus' Antiq., book* 1, *chap.* 12.

Clement of Rome, a contemporary of Josephus, also mentions this pillar, and likewise Irenæus, a writer of the second century, who, yet more superstitious than the other two, adds the hypothesis, how it came to last so long with all its members entire. Reland relates an old tradition that as fast as any part of this pillar was washed away, it was supernaturally renewed.

At 10.42 a large black and white bird flew up, and lighted again upon the shore. The salt on the face of Usdum appeared in the form of spiculæ. At 11.07, came to the cave in Usdum described by Dr. Robinson; kept on, to take meridian observation at the extreme south end of the sea. 11.28, unable to proceed any further south from shallowness of the water, having run into six inches, and the boats' keels stirring up the mud. The Fanny Skinner having less draught, was able to get a little nearer to the shore, but grounded 300 yards off. Mr. Dale landed to observe for the latitude. His feet sank first through a layer of slimy mud a foot deep, then through a crust of salt, and then another foot of mud, before reaching a firm bottom. The beach was so hot as to blister the feet. From the water's edge, he made his way with difficulty for more than a hundred yards over black mud, coated with salt and bitumen. . . .

In returning to the boat, one of the men attempted to carry Mr. Dale to the water, but sunk down, and they were obliged separately to flounder through. When they could, they ran for it. They describe it as like running over burning ashes — the perspiration starting from every pore with the heat. It was a delightful sensation when their feet touched the water, even the salt, slimy water of the sea, then at the temperature of 88°.

The southern shore presented a mud-flat, which is terminated by the high hills bounding the Ghor to the southward. A very extensive plain or delta, low and marshy toward the sea, but rising gently, and, farther back, covered with luxuriant green, is the outlet of Wady es Sâfieh (clear ravine), bearing S. E. by S. Anxious to examine it, we coasted along, just keeping the boat afloat, the in-shore oars stirring up the mud. The shore was full three-fourths of a mile distant, the line of demarcation scarce perceptible, from the stillness of the water, and the smooth, shining surface of the marsh. On the flat beyond, were lines of drift-wood, and here and there, in the shallow water, branches of dead trees, which, like those at the peninsula, were coated with saline incrusta-

THE HIGHWAY TO THE EAST

FROM A PHOTOGRAPH

This view of the port of Port Said on the Suez Canal represents one of the greatest highways of commerce in the world. Its originator, Monsieur de Lesseps, projected also the Panama Canal, which, however, has been left to American brains and money to bring to a successful issue.

tion. The bottom was so very soft, that it yielded to everything, and at each cast the sounding-lead sank deep into the mud. Thermometer, 95°. Threw the drag over, but it brought up nothing but soft, marshy, light colored mud.

It was indeed a scene of unmitigated desolation. On one side, rugged and worn, was the salt mountain of Usdum, with its conspicuous pillar, which reminded us at least of the catastrophe of the plain; on the other were the lofty and barren cliffs of Moab, in one of the caves of which the fugitive Lot found shelter. To the south was an extensive flat intersected with sluggish drains, with the high hills of Edom semi-girdling the salt plain where the Israelites repeatedly overthrew their enemies; and to the north was the calm and motionless sea, curtained with a purple mist, while many fathoms deep in the slimy mud beneath it lay embedded the ruins of the ill-fated cities of Sodom and Gomorrah. The glare of light was blinding to the eye, and the atmosphere difficult of respiration. No bird fanned with its wing the attenuated air through which the sun poured his scorching rays upon the mysterious element on which we floated, and which, alone, of all the works of its Maker, contains no living thing within it.

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## A VISIT TO THE ROCK TEMPLES OF CEYLON.

BY

A. H. Hallam Murray.

I AWOKE one December morning to find myself once more off the coast of Ceylon, and going on deck saw the sun rise gloriously behind Adam's peak, which stood up amongst the surrounding mountains clear against the Eastern sky. . . .

We started, a large party, in the Governor's saloon for

From "The High Road of Empire." Water color and pen and pencil sketches. London.

a twenty-mile run to Matale. Part of the way I rode on the engine with Captain Pirie, and greatly enjoyed the beautiful country, dense woods alternating with stretches of paddy-fields in the valleys, with small villages of mud huts amongst the cocoa-nut groves, and bold mountains rising beyond. On arriving at Matale we found the carriages and red liveries waiting for us, and drove off through the gay and picturesque little town, thronged with natives in bright clothes, and two miles beyond, along a well-shaded and level road, to the monastery of Alu Vihara. This monastery consists of a series of small temples, occupying wedge-shaped cavities in a group of gigantic gneiss rocks, which at some remote period must have fallen from the overhanging mountains behind them. They stand on a height above the road, and are approached by a winding path, up steep flights of steps and over slopes of rock; a few minutes' walk brought us face to face with them.

It is said that in this temple or temples scribes were employed by a Sinhalese king to reduce to writing the doctrines of Buddha. It is certainly probable that writing was unknown at the time of Buddha, and many people think that the canon of Buddhist scriptures, till then handed down orally, was first written down in Ceylon about B. C. 85.

In one of the rock chambers is a huge recumbent figure of Buddha, some 40 feet in length, cut out of the solid rock. The interior of the temples, profusely decorated, was being thickly repainted with oil paint of the brightest colors. A law, passed by Sir Arthur Gordon, compels the priests to render a periodical account of the expenditure of their funds, which are considerable, consequently they were everywhere actively wielding the paint-brush so as to make as much show as possible, and carving new effigies of Buddha. At the top of one of these great rocks there is an artificial indentation, representing a huge footprint some three feet long. This is, of course, one of the many footprints of the founder of the faith to be found in Buddhist countries; the most celebrated being

that upon Adam's peak. To reach the indentation it is necessary to climb up the face of the rock by roughly-hewn steps. . . .

The sun was rapidly sinking as we approached Dambool. A path to the left, just short of the village, strikes upwards over the rounded surface of one of the gneiss rocks, then winds amongst fallen boulders and bushes and up steep steps toward another stretch of rock like the first; after eight or ten minutes' walk we found ourselves at the temple gate. Here the resthouse-keeper from Dambool overtook us with a lantern, for when the sun sinks it soon gets dark, and the way is far from easy to find.

This cave temple, from its antiquity, its size and the richness of its decoration, is the most renowned in Ceylon; it is divided into five chambers of unequal size, formed in a natural wedge-shaped cavity of the rock, and in front of this long cave is a platform looking over the plain and the hills westward and down the wooded slopes immediately below. In the large trees, including, of course, a sacred Bo-tree (*Ficus religiosa*), growing on and about the edge of this platform, there are crowds of monkeys chattering and swinging themselves from bough to bough. A richly sculptured doorway opens into the first temple, in the least deep part of the cave, where there is a colossal recumbent figure of Buddha, about 40 feet long, carved out of the rock; his elbow rests on his pillow, which is in creases, indicating the weight which draws it down. This is the attitude which represents the Buddah as sinking into complete Nirvana.

The other temples — entered from a balcony or gallery, partly of rock and partly masonry — are larger, and crowded with figures of Buddha, mostly seated, and with gigantic figures of some of the Kings of Kandy. The walls and roof are covered with oil paintings of angels standing on clouds, with nimbi round their heads, illustrating the history of Buddhism, the Landing of Wejayo, the Preaching of Mahinda and the contest between Destigaimanu and Elate, in which the combatants are mounted on elephants. The table in front of the great

Dagoba, where the worshippers lay their offerings of flowers, was covered with a cloth, much stained by the surrounding lamps and candles. I was attracted by a mark upon it, and looking closer discovered it to be a large cotton handkerchief with a printed portrait of Lord Dufferin upon it.

By the time we had seen these temples and a dripping well of clear water, which falls from the middle of the ceiling into a small tank below, the sun had set in a glory of gold, and the effect was very striking as we looked out from the darkness of the temple, through the pointed arch of the doorway, the reflected light streaming in on dim figures of worshippers and yellow-robed priests flitting about.

A friend at Kandy had strongly recommended me not to leave Dambool without seeing the rock fortress at Sigiri, eleven miles distant, so I proceeded to make arrangements, and eventually found a man with a bullock cart, the only form of conveyance, who agreed to provide me with a pair of trotting bullocks and a light cart on payment of fifteen rupees: he explained that he could not do it for less, as it was necessary to send on two extra coolies, six miles ahead, with the relay of bullocks, on account of the elephants which stray across the road at night, and might interfere with the cattle if they had not sufficient protection. I was also told that there were plenty of cheeta and elk about Sigiri and its neighborhood.

We were up betimes the following morning, and I got under way at seven, but the light wagon proved to be very much the reverse and too heavy for the tiny bullocks to trot with, and those sent on were the ordinary heavy goers; however, the road was in part a mere track through the thick jungle, and so rough and circuitous, on account of tree trunks, that I doubt whether we could have trotted much even if we had had other kine. We took three hours to do the eleven miles, and a pretty tedious drive it was. The road is almost level all the way, and the forest is so thick and interlaced overhead with

branches that nothing could be seen beyond a few yards distant.

The ordinary bullock cart of Ceylon is a springless affair, a mere platform on two wheels, with a palmleaf hood projecting beyond it fore and aft. On it a driver with taste, sometimes hangs a flower-pot or can, and in it plants a gourd or some such plant, which trails all over the hood. We had nothing of that sort, however. The resthouse-keeper supplied me with a mattress and a pillow, and if I did not lie down I had to sit cross-legged or dangle my legs out at the back. The "boy" who accompanied me as guide and interpreter was incapable of acting in either capacity, for he had never been to Sigiri, and his English vocabulary was of the most limited. He was like a very unattractive old woman, with a red petticoat and grey hair in a knot at the back. A group of three or four huts are the only human habitations to be seen along the route.

Sigiri is an immense rock, 400 feet in height, with almost perpendicular or, in fact, overhanging sides rising abruptly out of the plain, very much in the same way that the Bass rock emerges above and out of the sea. In this rock-fortress the parricide King Karyapa found asylum in the fifth century, after obtaining the throne of Ceylon by the murder of his father, Dhatu Sena. It stands in the heart of the great central forest, and the only habitation near it is am empty bungalow, which affords shelter to any one who may wish to stop there, but contains nothing whatever in the form of furniture. A path from it leads to the steep slopes which form the base of the rock. On them are the remains of what was once a royal palace. An immense boulder has had its top sliced off to form the floor of a hall, which is still surrounded by a roughly-moulded and hewn stone cornice. Here and there are put-log holes, which seem to imply a continuation in woodwork, and on one side is a higher rock furnished with incised steps which lead to a flat place on its summit, with a hewn tank, about 10 feet by 5 feet, for the storage of water. Close by I noticed a large forest tree swaying

about as if blown by a strong wind; on looking a second time I saw that its branches were crowded with apes jumping from bough to bough, some frightened, as I imagined, by our approach, some simply swaying the branches for fun.

A scramble over loose stones and along a narrow gutter-like path hewn out of the steep side of the rock, then a climb upon a bamboo ladder, brought us to a gallery along the side of the rock with a high masonry balustrade or wall on the outside and the rock above projecting over head. This gallery used, I believe, in former days to wind in spiral fashion up to the top of the rock; but now, unfortunately, it has been broken down, and we soon came to an abrupt halt, with a deep drop in front of us, where the wall and footway were broken away. I had to content myself with the extremely beautiful view toward Matale across the dense sea of jungle which surrounds the rock.

Above this gallery, but only to be reached by rope ladders, of which we had none, is a curious cavity or pocket in the rock, with its ceiling covered with frescoes representing, I was told, remarkably well-drawn life-sized figures. A namesake of mine had recently climbed up to this pocket and had made tracings of the frescoes; he said the place was now the stronghold of swallows and hornets, which resent the intrusion of strangers. At the foot of the rock is a marshy tank, the haunt of crocodiles.

The drive back was tedious and uneventful, except that in a small forest village through which I passed I encountered an albino woman; her hair was light and colorless, and her skin was much freckled, the simplicity of her costume accentuated the strangeness of her appearance. For the last mile we found the road thronged with pilgrims returning from Anuradhapura. A highly picturesque and motley crew, with brilliant garments and bright red umbrellas; all the old people were in bullock carts and the younger ones on foot; amongst them were many priests in their orange-colored robes.

I reached Dambool at five, with only just time enough before nightfall to rush up to the temple again and make a few pencil sketches. It was quite dark when I left the dim lights of the temple and began my return walk. I soon found that it was hopeless to try and find my way down the steep rock, except by a more rapid descent than I cared for, and I returned to the temple, where I found a native sufficiently intelligent to understand what I wanted, and with him as my guide and lighted by a screw of paper dipped in tallow, which smoked and smelled atrociously, we made our way through the darkness and found a man from the resthouse, at the bottom, looking for me with the lantern.

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## JUNGLE LIFE IN BURMA.

BY

R. Talbot Kelly.

LEAVING the bungalow at sunset, a two-hours' ride in the starlight brought us to Sathwa. The road, so called by courtesy, was terribly bad, and riding would have been difficult even by daylight, as the track (for it was little else) had been so badly cut up by cart wheels during the rains, which were only just over, that it was scored in all directions by ruts a foot or more in depth, which the sun of the last few days had baked as hard as bricks. Added to this was the fact that on either side were dense masses of jungle and forest growths, which effectually impeded what little light there was, and hid these pitfalls in an impenetrable gloom. I consider that it was more by good luck than anything else that we got through without an accident or damage to the ponies. However, we reached the dâk safely about 9 p. m., and turned in early, preparatory to our start at sunrise.

From "Burma painted and described." London.

I was interested during the ride to hear our Burmese attendants singing at the pitch of their voices, an ebullition which I attributed to pure light-heartedness until I noticed that they sang *loudest* where the road was *darkest*. In reply to my inquiry, Maclennan informed me that the men were singing, "not for the fun of it," but in order to frighten away the "Nats." This superstitious feeling I found accounted for another fact which had attracted my attention. When moving, the Burmese carts are always accompanied by a horrible groaning and squeaking of the wheels; I suggested a little grease on the axles, but learned that they preferred to have it so, as the noise, which traveled an immense distance in the still air, not only wards off the evil spirits of the forest, but also serves as a warning to their wives at home that the "master" was homeward bound, and would shortly be in want of his supper!

The dâk at Sathwa was much as others, except that the flooring boards were set so far apart that we experienced as much breeze from underneath as from the open verandah, and one had to be careful as to the position of the legs of chairs or camp bed, and as a matter of fact, while taking my bath, both sponge and soap dropped between the boards and had to be sought for below by candle-light.

The following morning elephants had arrived and were loaded up with our baggage and sent off, we following a little later on pony-back.

A fatiguing journey through "paddy" fields, scrub jungle, and occasional forest patches, lay between us and Kokogon, in the heart of the forest itself, and to be my headquarters for the time being.

Traveling was slow and tedious owing to the absence of roads. In the cultivated lands the only pathway consisted of the tortuous little bunds or dykes which separated the irrigated patches, while in the forest dense undergrowth, largely of thorns and creepers, impeded progress and made riding difficult.

I was very much surprised at the speed with which the elephants covered the ground. Through the difficult "paddy" land they were quicker than the ponies. In some places the bunds were very narrow and slippery, while every here and there were little creeks crossed by a single log, or else by means of a ford in which the ponies floundered heavily in mud a couple of feet or more in depth, yet in every case the elephants negotiated these difficult crossings more comfortably than the ponies.

The "paddy" was ripe and harvesting in full operation. The Burmans use sickles for reaping, cutting the straw half-way up so as to gather some and yet leave enough for the cattle in the fields to browse upon. The rice is bound into sheaves with a "strap," as in England, and is later on carted to the "talin" or threshing-floor, where, in the usual Eastern manner, the grain is trodden out by bullocks. Winnowing is performed by means of a circular tray, about two feet in diameter, which is tossed into the air with a rotary motion, so as to set all its contents spinning, the chaff being blown away while the grain falls at the operator's feet. . . .

The country through which we had passed was extremely pretty in its general effect — immense tracts of "paddy" land, interspersed with trees, among which were the villages of the peasants, in many cases surrounded by groves of bananas and other fruit-trees, while large pools, overgrown with lotus, were a common feature.

The moisture in the saturated land, sucked up by the powerful sun, filled the air with an impalpable mist which enveloped the landscape in a silver haze, and gave to its features a suggestiveness which was charming. Distances which were not really great appeared to be immense, and the sun, shining through the laden atmosphere, glorified even the monotony of the rice-fields with opalescent tints, amidst which the brightly colored costumes of the natives shone like jewels. This silvery curtain, which lends such enchantment to the commonplace, I found to be general in the cultivated lands, and

during the few hours of its continuance it seems to envelop nature in a poetic glamour difficult to describe.

Our entrance into the forest was almost abrupt, the "paddy" land being succeeded by patches of kaing grass, bamboo, and a tangled growth of all kinds, glittering under a hot sun, which caused the steam to rise from the pools and damp patches of the paths well into the day. Some of the vistas were very lovely, the nearer points standing out strongly against a distance hazy in the hot air, through which our elephants loomed large and almost phantom-like.

Huge trees of to me as yet strange growths towered above the undergrowth, their individual characteristics being largely lost in the profusion of creepers which enveloped them in a uniform habit of leaves and flowers, and whose sinuous stems winding through the grasses tripped up our ponies and rendered riding slow and difficult. Evidently the haunt of game, all we saw on this march were a few "gyi" or barking deer, which dashed across our path, though this forest abounds with tiger, panther, and elephant, while everywhere among the succulent undergrowth were signs of large herds of "pig."

Birds there were in plenty, miners, hoopoe, king crow, jungle fowl and owls, also a large number of paddy birds, the female of which, I noticed, is not white but parti-colored, brown predominating, which makes her very difficult to find when nesting. Doves were cooing, and in the nyoung-bin trees the green pigeon was whistling a melody which Skeene once declared to be a few bars from *The Belle of New York!* There is one bird, however, which I have met with in different parts of Burma, but whose species I have never been able to discover, whose song consists of a distinct musical phrase of several bars. He is a small bird, with a liquid note, rich and full, and his song sounds gloriously beautiful in the often solemn surroundings of the forest.

Squirrels were there in large numbers, disputing with the monkeys for possession of the nut-trees, while flitting across the glades flights of parrots flashed brilliant in the sunlight.

That wild animals always look their best in their natural environment is a truism which certainly applies strongly to the parrot. Seen at home as a caged bird he has little beauty, and might almost be described as grotesque. Here, however, in these primeval forests, he is a creature of beauty and joy. Hear him whistling softly to his mate, or exchanging calls with his fellows as he sits in the topmost bough of a cotton-tree, 200 feet above ground. Every note is flute-like and coaxing, and, as his song floats downwards towards you through the sun-bathed air, each note is mellowed and sweetened on its journey. Or again, as a flock suddenly launches itself into space, and plays "follow my leader" through the tree-tops, what could be prettier than they as their orange beaks and long slender tails glint in the sunlight! It is a revel of song and color and pure light-heartedness foreign to their caged and subdued relatives in this country. Here a parrot is simply a curiosity, there a beautiful creature, suited to its surroundings, and bringing an air of gladness and color into what might otherwise have been an oppressive exuberance of forest growth.

Curiously enough, there were few insects; no doubt as the heat was intense they were lying dormant in the leafy shades. Butterflies, however, were plentiful and of great beauty.

Traveling in the paddy land had been difficult. Here, however, it was more so; the open glades were often marshy, and under the powerful sun were giving up steam as at mid-day. Riding through the thickets was almost impossible on account of the hidden creepers which made it difficult for the pony to travel, and the thorns which lacerated the rider and the beast indiscriminately, so that of two evils it was usually better to stick to the open and be grilled, than risk the difficulties and perhaps dangers of the denser forest.

Few signs of human life disturbed the solitude of these wilds. Here and there were little clearings planted in rice or sessamine, over which grotesque scarecrows stood

sentinel, or perhaps an occasional hut of bamboo and grasses marked the halting-place of previous travelers; and once I saw a boy engaged in snaring wild-fowl by the aid of a decoy cock, the *modus operandi* apparently being to tether the bird in a patch of short grass, where he is surrounded by a circle of snares composed of twigs, and the forest bird, responding to his challenge, comes down to fight him and is caught.

Kokogon is practically the center of a large teak forest, which was being worked by the Corporation. Their bungalow, which is some little distance from the native village, was pleasantly situated in an island of grass surrounded by dense forest and jungle, and overlooking the Kyouk-mee-choung, a forest creek or river, where a number of elephants were at work clearing a "pone" of logs brought down by the last freshet.

Behind the bungalow were storehouses, stables, and the huts of the woodmen, among which moved the wives and children of the foresters bringing in sticks, and kindling fires preparatory to cooking the evening meal. Below us, in the shade of the bungalow, our ponies were being attended to and the baggage unloaded from the elephants.

Later in the afternoon all the elephants at work in the creek, twelve in all with three calves, came in for their evening feed: a picturesque sight, as each, mounted by its "oozi,"[1] came to the steps of the bungalow to "salaam," and perhaps receive a "tit-bit," before proceeding to the lines where rows of buckets containing rice are waiting ready for them. After feeding, the elephants go down to the creek to bathe before being turned into the jungle for the night. Very pretty was the scene, as the declining sun caught the red cliffs which formed the river's banks, and lit up the mixed foliage of the forest with a ruddy light, to which the deep gloom of the shades offered a striking contrast. As the sun, red and glorious, slowly disappeared behind the trees, crickets and frogs began their evensong, while in the distance the trumpeting of an elephant, or the impatient squeal of a calf which

[1] Driver.

had temporarily lost its mother, were the only sounds to break the solemn hush which comes over the forest at sun-down. Presently, as the evening breeze rustled through the tree-tops, the cry of the jackal and hoot of the owl broke the stillness, and the rising moon completed the poetic feeling of a scene which combined so much of suggestion with its solemn beauty.

Altogether the day's experience had been of extreme if somewhat bewildering interest. Many sharp contrasts had presented themselves on the way, culminating in this rich forest scenery, which as yet I had hardly begun to understand, so entirely different was it from anything I had hitherto seen. Beautiful but impressive, solitary yet alive, I felt that I must discover many of its secrets before I could hope to fully appreciate its fascination myself or pen an adequate description for my friends.

As is perhaps generally known, teak, pyingado (iron-wood trees), and several other species are "protected" by the Government, their extraction being sanctioned under certain well-defined rules. Pyingado is too heavy to be profitably worked except locally for the purpose of railway sleepers, and the attention of the great firms is entirely devoted to the extraction of teak, licenses for which are granted, and zones or "forests" allotted to them in consideration of the rather heavy royalties charged upon the logs marketed. Each of these forests is managed by a representative of the firm concerned, assisted by several subordinates who supervise the work being carried on; the selection of trees to be felled, however, rests entirely with the Government forest officer, and is made with proper regard to the replenishment of the forests under his control.

The trees selected are "girdled" by cutting a ring through the bark and sapwood until the hard wood is entered, the result being that, cut off from any supply of moisture from the roots, the tree dies, and the bark, leaves, and twigs having fallen off, the naturally seasoned tree is felled at from two to three years after girdling. The trees are reckoned first or second class trees accord-

ing to their size, the former being from 6 to 7 feet and the latter about 4½ feet in girth, their ages varying from 35 to 120 years, I believe. The teak is a handsome tree, straight-stemmed, as a rule, branching much like an acacia at about 25 or 30 feet from the ground. Its leaves are very large, shaped like an elm but smoother, and they have a purple blossom which stands up from among the foliage, remaining on the tree for a considerable time after the leaf has fallen.

After felling, the difficult work of transport begins. In many cases the logs lie in inaccessible parts of the forest, which necessitates the making of roads and building of bridges before the work of hauling can be commenced. Large numbers of elephants and bullocks are engaged in this work, and in one place at least the Corporation have a traction engine at work. In this process of transportation the forest rivers or creeks are used to the utmost, until finally some large waterway is reached by means of which the rafted logs may be floated down to the sea.[1]

These creeks seem to be more or less of the same character. Though there is always a little water flowing in the bed, it is only after rain that they can claim any title to be called rivers. Owing to the steepness of the watershed and the extraordinary amount of rainfall when it occurs, what before was a sleepy succession of pools, half stagnating in the sun, becomes almost immediately a rushing, swirling river, carrying with it tree-trunks and all kinds of forest debris. These floods are the opportunity for the "jungle wallah," who has been busily employed in teak felling and hauling in readiness for a rise. All hands are busily engaged in launching logs into the stream, along whose banks are stationed parties of men and elephants shoving off logs should they strand, and with almost superhuman effort and at considerable risk of life relieving a "jam," which is often caused by the

[1] I hope I am not exaggerating, but my recollection is that often as long a period as nine, or in some cases even twelve years elapses between the girdling of a tree and its final arrival at the sawmills at Rangoon.

falling of a forest tree where the flood has undermined the bank. It is a time of high pressure and strenuous effort on the part of all engaged in the work, for these streams form the easiest, sometimes the only, means of transit, and a freshet when it occurs must be utilized to its fullest advantage. I am told that it is not infrequent for men engaged in the teak forest to be out for two or three days continuously, the whole time working night and day under the extremest physical discomfort caused by drenching rain and smothering mud, unable for a moment to relax the closest concentration upon work which demands the maximum of physical endurance, resourcefulness, and pluck. The river falls as quickly as it rises, and leaves the logs committed to its charge stranded in piles called "pones," or perhaps in single logs dotted here and there throughout its course. These pones are usually formed by an obstruction, such as an impending rock, or where a log sticks upright in the muddy bed. In some cases, however, the logs are collected into a "pone" by means of a boom placed across the creek to prevent them going farther down stream. This boom is called "thittagah," which means literally "a door for logs." Such a place was Kokogon, where the elephants were engaged in hauling the collected timber up a slide of rollers on to the high bank, from where it will presently be hauled through the forest by bullock wagon or traction engine to another and a larger stream, which will float it down to Rangoon.

Apropos of this, one of my companions had a somewhat curious adventure while engaged on the work which I have been describing. He was making his way down the creek, finding such foothold as he could, and presently stood upon what he took to be the root of a tree lying on the face of the steep bank. He was much alarmed to find it move and to witness the erection of an enormous neck and head at the end farthest from him. What he had taken for a twisted tree-stem proved to be a 13-foot python, and, as he told me, he "let off a yell" and both barrels of the gun which he happened to be carrying as

he jumped for the river bed. Luckily the python was killed, and he took the skin, of which he is very proud.

I have previously remarked upon my not having seen a snake so far, but closely following upon the above adventure, one morning in going to my work I trod upon a cobra, which fortunately was more alarmed than myself and darted off at amazing speed into the thicket; and the same evening one of our party in feeding the camp fire, picked up what he thought to be a chip, but which was nothing less than a Russell's viper, one of the most deadly snakes of Burma. Fortunately he had "caught it right," and dropped it before any harm was done.

With regard to snakes generally, I think it is unquestioned that the reptile is, in most instances, as anxious to get out of the way as the human being to avoid it. An exception, however, occurs in the case of the hamadryad or king cobra, which is aggressive. A friend of mine in the Katha district told me how, when chased by one of them, he, though an extremely athletic man, had the greatest difficulty in getting away, so rapid was its movement, and it was only by throwing down his gun and cartridge-bag that he was able to outdistance his pursuer.

It is interesting to watch the elephant at work; their sagacity is remarkable, and they hardly seem to require the direction of the "oozis" who sit astride their necks, encouraging them with cries of "kalai" (brother), or repressing the refractory ones with their "choons."[1] In order to assist his driver to mount, an elephant will either kneel, or by bending the fore-leg, upon which the "oozi" steps, lift him until his seat is reached. The prettiest method, perhaps, is when the elephant, bending the head, curls up his trunk, which, together with his broad forehead, forms a simple and easy staircase for its driver. Approaching a log the elephant will look at it and touch it deprecatingly with his trunk, and having mentally decided as to its probable weight, will either lift it as directed, or should he consider it too heavy, will

[1] Driving hooks.

## ELEPHANTS PILING TEAK

"We useter watch the steamers and
the hathis pilin' teak."

Elephants a-pilin' teak
In the sludgy, squdgy creek,
Where the silence 'ung that 'eavy
you was 'arf afraid to speak,
On the road to Mandalay.

—Rudyard Kipling.

positively decline to touch it unassisted. Very clever, too, is the manner in which they avoid obstacles, stepping over logs, chains, etc., as they go about their work. In lifting timber, both trunk and tusks are used, and it is extraordinary how they marshal and sort the logs, laying them neatly and evenly in their places, shoving with the head and rolling them over until arranged to their satisfaction; or, when loading the trolleys, how carefully the log is laid down, and then pushed forwards or backwards until a perfect balance is obtained.

Highly intelligent animals, they are apparently docile also, except when the male goes "must," or in the case of a female with a calf. Then either is a very uncertain quantity; the calves also are most pugnacious, even vicious, and as even a "youngster" will weigh close upon half a ton, and is quite able to squash the life out of any one, they are not to be trifled with by any means.

I was one day taking a photograph of the elephants at work at the top of the slide by which the logs were hauled from the river to the top of the bank. Wishing to get a good one, I was focussing carefully on the screen, my head being under the cloth; suddenly I noticed one of the elephants becoming larger, very rapidly, and at the same time heard shouts of "Look out!" Without waiting to see what was going on, however, I snatched up my camera and dropped over the steep bank into the river bed below. I then discovered that I had been charged by one of these fond mothers, and had narrowly escaped a serious danger. The elephant in question, I afterwards learnt, had previously killed two of her "oozis," and was altogether a lady to be avoided.

Generally speaking, a great attachment springs up between the elephant and his driver, who is often devoted to his charge. I heard of a case where an employer, on transferring his elephants to a new district, asked one of the drivers to leave his village and come also. "Of course," he replied, "how can I leave my elephant; he is my father, with whom I have worked thirteen years."

On the other hand, elephants have a strong objection

to ponies and Europeans, especially when approached from behind. Several times in moving through the forest I came upon our "travelers" unexpectedly, and in every case the elephant, striking his trunk upon the ground, and giving a shrill metallic cry, quite different from his ordinary trumpeting, would turn round to attack. My pony, however, was always ready, and quickly carried me out of sight among the trees.

I was rather surprised to learn how tender are elephant's backs, and the greatest care must be exercised in loading up a "traveler" to ensure a perfect balance of the load, or a sore back is sure to result. Curiously enough also, they suffer a good deal from the bites of mosquitoes and other stinging insects, and I have, on several occasions, seen the blood trickling down their corrugated and seemingly impenetrable hides from this cause.

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## AT HOME IN FIJI.

BY

C. F. Gordon Cumming.

Constance Frederick Gordon Cumming was born in 1837. She was of an ancient Scottish family, a woman of rare talent and scientific attainment and was a friend of Hugh Miller, Agassiz, Sir R. Murchison, etc. She traveled extensively in the Pacific Islands, spent two years in Ceylon, two in Fiji and visited Tahiti, China, Japan, California, Hawaii, New Zealand, and New South Wales. She published many books of her experiences in these places and her descriptions are always vivid, clear, and interesting.

JUST below us lies the harbor (of Levuka) like a calm sea-lake, on which ride vessels of all sizes: trading schooners and brigs, which carry the produce of the isles to Australia and New Zealand. Larger vessels trade with Germany. Then there is an occasional man-of-war or merchant steamer, and always native canoes passing to and fro, with great three-cornered yellow mat sails, and brown men, who often sing quaint *mékés* as

From "At Home in Fiji." London.

they approach the town, with an odd sort of accompaniment on their *lali*, or wooden drum. The chiefs' canoes carry a flag, and sometimes a fringe of streamers of native cloth floating from the sail; and the canoe itself is adorned at both ends with glistening white shells like poached eggs (*Cyprea oviformis*). Sometimes several canoes pass us racing, or they meet, and their sails at different angles form pretty groups. How striking a scene it must have been, when, in the old days, the chiefs sailed forth to war at the head of a large fleet of these! On one such occasion, when Thakombau went to attack Verata, he mustered a hundred and twenty-nine canoes. Only think how bravely they must have flown before the breeze, with the golden sunlight on the yellow sails! These canoes are balanced by large outriggers — that is, a beam of wood, or piece of cocoa-palm stem, floating alongside, and attached to the canoe by bamboos. They are most picturesque, and the great mat sails, seen against the intense blue of the water, are a valuable addition to the scene. Indeed the eye that loves exquisite color can never weary here.

The rich blue of the harbor is separated from the purplish indigo of the great ocean by a submarine rainbow of indescribable loveliness. This is caused by the coral-reef, which produces a gleaming ray as if from a hidden prism. The patches of coral, sea-weed, and sometimes white sand, lying at irregular depths, beneath a shallow covering of the most crystalline emerald-green water, produce every shade of aqua marine, mauve, sienna, and orange, all marvelously blended. The shades are continually varying with the ebb and flow of the tide, which at high water covers the reef to the depth of several feet, while at low tide patches here and there stand high and dry, or are covered by only a few inches of water; treacherous ground, however, on which to land, as the sharp coral spikes break under the feet, cutting the thickest leather, and perhaps landing you in a hole several feet in depth, with still sharper coral down below. The highest edge of the reef lies towards the ocean, and a line of

dazzling white surf marks where the great green breakers wage their ceaseless warfare on the barrier; but the passage through the reef is plainly marked by a break in the white line, and a broad roadway of deep blue connecting the inner waters with the great deep; and this, again, passes in gradual gradations of color, from the intense blue of the harbor to the glittering green of the shallow water on the inner side of the reef. Altogether it is most fascinating. The scene is loveliest at noon, when the sun is right overhead, and lights up the colors beneath the water in the coral caves. Also you must be some way up the hill to get a good view of the reef. Of the radiant opal tints which overspread sea, isles, and sky, at the outgoings of morning and evening, I need not tell you; our own northern shores supply sunrise and sunset colors more vivid than we often see in the tropics.

This afternoon has been one of unmitigated enjoyment spent on the reef, where for so many days I have enviously watched the Fijian girls disporting themselves at low tide, and bringing back baskets full of all sorts of curious fish, many of them literally rainbow-colored. Some are most gorgeous, and are called parrot-fish. They have large bony beaks, rather than ordinary mouths, to enable them to feed on the coral, which at certain seasons are said to be "in flower," and very unwholesome; so we always eat these radiant fish with some qualms, and not without good reason, for some people have had the ill-luck to get poisoned, and have suffered severely in consequence.

Our great authority on all questions of natural history is Mr. Layard (brother of "Nineveh" Layard), who, before annexation, held the office of British Consul in this place. He and his son have a special talent for capturing strange monsters of the deep, and I never call on Mrs. Layard without her showing me some new object of interest. They live in a large old wooden house, built on the very edge of the water; in fact, the sea washes up underneath the veranda, which opens on a long wooden pier in the last stages of decay. I should think the position most

unsafe, in view of possible tidal waves, especially as a small mountain stream (which occasionally becomes a torrent) washes one side of the house — so that from one window the inmates can have fresh water fishing, and from the other salt. That old pier has been a source of infinite pleasure to many. It enables Mrs. Layard to have a little fresh air, and a small walk, without venturing among the broken bottles and mud which form the beach; and her husband and son thence capture many strange creatures when they have not time to row off to the reef, which is, of course, the very ideal of a naturalist's happy hunting-grounds, and there they took me this afternoon. You really cannot imagine anything more lovely than it was. The first essential is to go in a boat which draws very little water, and which has no new paint to be considered. Then when the tide is low, and the sea without a ripple, you float idly over the coral-beds, suffering your boat to lie at rest or drift with the current, as a stroke of the oars would disturb the clear surface of the water, beneath which lie such inexhaustible stores of loveliness. Every sort and kind of coral grow together there, from the outstretched branches, which look like garden shrubs, to the great tables of solid coral, on which lie strewn shells and sponges, and heaps of brain and mushroom corals.

These living shrubs assume every shade of color: some are delicate pink or blue; others of a brilliant mauve; some pale primrose. But vain is the attempt to carry home these beautiful flowers of the sea; their color is their life. It is, in fact, simply a gelatinous slime, which drips away, as the living creatures melt away and die, when exposed to the upper air. So the corals we know in England are merely skeletons, and very poor substitutes for the lovely objects we see and covet in their native condition.

Besides, like everything in that submarine garden, much of its charm is derived from the medium through which we behold it — the clear translucent water, which spreads a glamor of enchantment over objects already

beautiful, glorifying the scarlet coralines and the waving branches of green and brown weed, wherein play exquisite fish of all vivid hues and sizes, from the tiniest gem-like atoms which flash in the light like sapphires and rubies, to the great big-headed parrot-fish, which has strong white teeth specially adapted for crunching the coral, and thence extracting the insects on which he feeds.

There are great red fish, and purple-green fish, and some of bright gold, with bars or spots of black; but loveliest of all are the shoals of minute fish, some of the most vivid green, others of a blue that is quite dazzling. Some have markings so brilliant that I can only compare them to peacocks' feathers. These all congregate in families, and a happy life they surely must have. Some of the loveliest of these are so tiny that you can keep a dozen in a tumbler; others are about the length of your finger. Only think what a prize they would be if we could convey them safely to the great aquariums at home! Besides these myriads of minute fish, there are all manner of living creatures which peep out from their homes beneath the ledges and crevices of the coral — vigilant crabs of all sizes and colors, and sea-anemones in endless variety, and wonderful specimens of Echini.

Picture to yourself first cousins of the fragile sea-eggs which used to rejoice our childhood, and make us marvel how they ever came ashore unbroken. These Fijian relations are armed with spikes like slate-pencils, nearly as thick as your middle finger, and a good deal longer. I think Mr. Layard said their name is Acrocladia. To-day we captured a most extraordinary creature, a starfish, which seemed as if it must be nearly related to the sea-urchin, for its fifteen arms were each covered with grey and orange spines, very sharp, precisely like those of the echinus, while the under side was a mass of pale-yellow fleshy feelers, like those of a sea-anemone, with a sucker at the end of each. It was a strange and most interesting creature when we first beheld it, but looked very unhappy when it found itself in a bucket; and when reduced to "a specimen," it will be a poor ugly object.[1]

[1] Acanthaster solaris.

FIJI NATIVE VILLAGE

The Fiji Archipelago consists of about 250 islands, of which 80 are inhabited. The native character is a series of curious contrasts. Highly intelligent, with a minute and elaborate social code, yet they were cannibals full of suspicion and treachery, but in many ways hospitable, generous and polite. They were sensitive, proud, vindictive and boastful, and very cleanly in their houses and their cookery. Civilization has done much to efface the more unpleasant phases of their character.

We saw a great number of large star-fish, of the deepest Albert blue, and innumerable other beautiful things, which gained greatly in interest from being shown to me by one so familiar with them all as is Mr. Layard. How you would delight in such an afternoon as this has been, and how the boys would revel in it! It is not altogether pleasant, however, to try walking on the reef, and you generally have to get natives to dive for anything particularly good. They never seem afraid of the many sharp teeth and stinging creatures which may dart out from the coral; and not being troubled by over-much raiment, they dive in and out like fishes (though, as a general rule, they do dislike wetting their hair). To them the reef is a source of endless amusement and profit, and at low tide there are generally some canoes lying in the shallow water; while the girls and young men are hunting for the spoils of the sea, which they carry in three-cornered baskets, slung from the waist. Of course they do not care to spoil their simple raiment with salt water, so a considerable portion of their dress on these occasions consists of deep fringes and garlands of many-coloured leaves, which are a most becoming drapery, with their rich brown skin and tawny head.

The existence of these barrier-reefs is an unspeakable benefit to the isles, supplying them with natural breakwaters and harbours, surrounding each with a lagoon of calm, shallow water, on which the smallest boats can ply as safely as on an inland lake, and within shelter of which they can, in most places, pass from one isle to another. There is invariably a passage through the reef opposite the mouth of any river, as the coral insect cannot live within the influence of fresh water. Thus an entrance is secured to the haven of rest, and a very strait and narrow way it often is, and one which calls for careful steering, when the angry breakers are dashing in mad fury on the reef on either side — great rolling waves curling upward in a succession of mighty walls of green water, and falling in such a surging cataract of foam as

would make short work of the luckless canoe that should drift within their reach. Once inside the reef all is secure, save when some unusual storm troubles even these calm waters, as it might ruffle the surface of any lake.

It is hard to realise that these mighty sea-walls are indeed the work of microscopic insects — star-like creatures, invisible to the naked eye; but so it is. It is said they cannot live at a greater depth than thirty fathoms, yet the height of the coral-wall is in many cases double or treble this measurement, and in some cases a sheer descent of two hundred fathoms has been found. The inference is, that many of these isles, as well as the ocean-bed from which the coral rises, are gradually subsiding, and the insects are continually working upwards. In some cases the island has altogether disappeared, and there remains only a circular or crescent shaped reef, perhaps fringed with cocoa-palms, encircling a calm lagoon of clear green water, the sea all round being of the deepest blue. These are called *atolls,* and are sometimes many miles in circumference. Some scarcely rise above the water-level, and only a ring of white coral sand betrays their existence.

The coral-reef gives us various hints of the rise and fall in the level of the ocean-bed, for while some islands have wholly disappeared, others are even now emerging from the waters. In some groups coral-cliffs have been found forty feet above the water-level — in other words, above the height where the insect could live, thus showing clearly that these rocks have been gradually upheaved. But in the Fijian group there are few islands which are not almost encircled by a barrier-reef of considerable depth, which would seem to indicate that they are actually subsiding. However, the process is likely to be a slow one, and a matter of no great moment to the present generation, or their successors for many years to come.

In one respect we are greatly disappointed in this place — *there are scarcely any flowers.* This strikes us all the more, as we have come here direct from Australia,

where we left the whole country literally aflame with blossom. You cannot fancy anything more lovely. And here in the tropics, where people always vainly imagine that flowers are so abundant, we have fewer than in any place I have yet been. Scarcely any house has even a flower bed round the windows; and the very best garden in the place would, except for the beauty of its crotons and other shrubs, scarcely be dignified with the name elsewhere; and yet infinite care is expended on it, and a handful of roses or other blossoms of any sort is the greatest boon its owner can bestow on us. As to wild flowers, I have walked day after day till I was weary, without finding as many flowers as would fill a small vase.

The ferns, however, are exceedingly lovely. Innumerable species grow in richest profusion in every damp ravine, and great tufts of birds'-nest and other ferns cling to the mossy boughs of the gray old trees. Every here and there you come on a rocky stream or shady pool round which they cluster in such luxuriance and variety, that it makes you long to transport the whole fairy-like dell to some place where all fern lovers might revel in its beauty. An this is only the undergrowth; for the cool shade overhead is produced by the interwoven fronds of great tree-ferns — their exquisite crown of green supported by a slender stem from twenty to thirty feet high, up which twine delicate creepers of all sorts, which steal in and out among the great fronds, and so weave a canopy of exquisite beauty. Loveliest of all are the delicate climbing ferns, the tender leaves of which — some richly *fringed* with seed — hang mid-air on long hair-like trails, or else, drooping in festoons, climb from tree to tree, forming a perfect network of loveliness. It is a most fairy-like foliage, and the people show their reverence for its beauty by calling it the *Wa Kolo,* or God's fern.

I ought to mention that though there are no flowers within reach, there are several flowering trees with unattainable, and, happily, not very tempting blossoms. They are all alike remarkable for having a most insignificant calyx, and being almost entirely composed of a great

bunch of silky stamens which fall in showers on the ground below. The most attractive of these is the *kaveeka,* or Malay apple, which bears tufts of crimson blossom especially attractive to certain lovely scarlet and green parrots with purple heads, and which in due season bears a very juicy though insipid crimson or white fruit. These parrots are few and far between; and I miss the flocks of bright wings which so delighted me in my glimpse of the Australian bush. . . .

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## CHRISTMAS IN THE ARCTIC REGIONS.

BY

ELISHA KENT KANE, U. S. N.

This famous American explorer was born in Philadelphia in 1820, and died in Havana in 1857. He was educated as a physician, was wounded in the Mexican War, and sailed in two expeditions sent by Henry Grinnell in search of Sir John Franklin. The story of the sufferings and hardships of himself and his companions is full of instances of courage and resourcefulness, and if they did not succeed in what they set out to do, they have left to the world an imperishable record of perseverance and devotion to duty.

"DECEMBER, 25, Christmas, Monday.—All together again, the returned and the steadfast, we sat down to our Christmas dinner. There was more love than with the stalled ox of former times; but of herbs none. We forgot our discomforts in the blessings which adhered to us still; and when we thought of the long road ahead of us, we thought of it hopefully. I pledged myself to give them their next Christmas with their homes; and each of us drank his 'absent friends' with ferocious zest over one-eighteenth part of a bottle of sillery—the last of its hamper, and, alas! no longer *mousseux.*

But if this solitary relic of festival days had lost

From "Arctic Explorations, the Second Grinnell Expedition in Search of Sir John Franklin, 1835-1855." Philadelphia.

NILS ADOLPH ERIK NORDENSKJÖLD

AFTER THE PAINTING BY ROSEN

This famous Swedish explorer was the first to sail around the north coast of Asia, returning by the way of Behring Strait. He has explored parts of Spitzbergen and Greenland. He was born in 1832. His name is pronounced *nor-den-shult.*

its sparkle, we had not. We passed around merrily our turkeys roast and boiled, roast-beef, onions, potatoes and cucumbers, watermelons, and God knows what other cravings of the scurvy-sickened palate, with entire exclusion of the fact that each one of these was variously represented by pork and beans. Lord Peter himself was not more cordial in his dispensation of plum pudding, mutton, and custard to his unbelieving brothers.

McGary, of course, told us his story: we hear it every day, and laugh at it almost as heartily as he does himself. Cæsar Johnson is the guest of 'Ole Ben,' colored gentlemen both, who do occasional whitewashing. The worthies have dined stanchly on the dish of beans, browned and relished by its surmounting cube of pork. A hospitable pause, and, with a complacent wave of the hand, Ole Ben addresses the lady hostess: 'Ole woman! bring on de resarve.' 'Ha'n't got no resarve.' 'Well, den'—with a placid smile—'bring on de beans!'

So much for the Merrie Christmas. What portion of its mirth was genuine with the rest I cannot tell, for we are practised actors some of us; but there was no heart in my share of it. My thoughts were with those far off, who are thinking, I know, of me. I could bear my own troubles as I do my eider-down coverlet; for I can see myself as I am, and feel sustained by the knowledge that I have fought my battle well. But there is no one to tell of this at the home table. Pertinacity, unwise daring, calamity—any of these may come up unbidden, as my name circles round, to explain why I am still away.

For some days before Christmas I had been meditating a sledge-journey to our Esquimaux neighbors. The condition of the little party under my charge left me no alternative, uncomfortable and hazardous as I knew that it must be. I failed in the first effort; but there were incidents connected with it which may deserve a place here. I recur to my journal for a succinct record of my motives in setting out:

"December 26, Tuesday.—The moon is nearly above the cliffs; the thermometer —57° to —45°, the mean of

the past four days. In the midst of this cheering conjunction, I have ahead of me a journey of a hundred miles; to say nothing of the return. Worse than this, I have no landmarks to guide me, and must be my own pioneer.

"But there is a duty in the case. McGary and Brooks are sinking, and that rapidly. Walrus-beef alone can sustain them, and it is to be got from the natives and nowhere else. It is a merciful change of conditions that I am the strongest now of the whole party, as last winter I was the weakest. The duty of collecting food is on me. I shall go first to the lower Bay Esquimaux, and thence, if the hunt has failed there, to Cape Robertson.

"My misgivings are mostly on account of the dogs; for it is a rugged, hummocked drive of twenty-two hours, even with strong teams and Esquimaux drivers. We have been feeding them on salt meat, for we have had nothing else to give them; and they are out of health; and there are hardly enough of them at best to carry our lightest load. If one of these tetanoids should attack them on the road, it may be *game up* for all of us.

"But it is to be tried at last: Petersen will go with me, and we will club our wits. I do not fear the cold; we are impregnable in our furs while under exercise, though if we should be forced to walk, and give out, it might be a different matter. We shall have, I imagine, a temperature not much above —54°, and I do not see how we are to carry heating apparatus. We have load enough without it. Our only diet will be a stock of meat-biscuit, to which I shall add for myself — Petersen's taste is less educated — a few rats, chopped up and frozen into the tallow-balls.

"December 28, Thursday.— I have fed the dogs the last two days on their dead brethren. Spite of all proverbs, *dog will eat dog*, if properly cooked. I have been saving up some who died of fits, intending to use their skins, and these have come in very opportunely. I boil them into a sort of bloody soup, and deal them out twice a day in chunks and solid jelly; for of course they are frozen like quartz rock. These salt meats are

absolutely poisonous to the Northern Esquimaux dog. We have now lost fifty odd, and one died yesterday in the very act of eating his reformed diet.

"The moon to-morrow will be for twelve hours above the horizon, and so nearly circumpolar afterward as to justify me in the attempt to reach the Esquimaux hunting-ground about Cape Alexander. Every thing is ready; and, God willing, I start to-morrow, and pass the four-hours' dog-halt in the untenanted hut of Anoatok. Then we have, as it may be, a fifteen, eighteen, or twenty hours' march, run and drive, before we reach a shelter among the heathen of the Bay.

"January 2, Tuesday.—The dogs began to show signs of that accursed tetanoid spasm of theirs before we passed Ten-mile Ravine. When we reached Basalt Camp, six out of eight were nearly useless. Our thermometer was at —44°, and the wind was blowing sharply out of the gorge from the glacier. Petersen wanted to return, but was persuaded by me to walk on to the huts at Anoatok, in the hope that a halt might restore the animals. We reached them after a thirty miles' march.

"The sinuosities of this bay gave fearful travel: the broken ice clung to the rocks; and we could only advance by climbing up the ice-foot and down again upon the floe, as one or the other gave us the chance of passing. It was eleven hours and over before we were at the huts, having made by sledge and foot-tramp forty-five miles. We took to the best hut, filled in its broken front with snow, housed our dogs, and crawled in among them.

"It was too cold to sleep. Next morning we broke down our door and tried the dogs again: they could hardly stand. A gale now set in from the southwest, obscuring the moon and blowing very hard. We were forced back into the hut; but, after corking up all openings with snow and making a fire with our Esquimaux lamp, we got up the temperature to 30° below zero, cooked coffee, and fed the dogs freely. This done, both Petersen and myself, our clothing frozen stiff, fell asleep through sheer exhaustion; the wind ouside blowing death to all that might be exposed to its influence.

"I do not know how long we slept, but my admirable clothing kept me up. I was cold, but far from dangerously so; and was in a fair way of sleeping out a refreshing night, when Petersen waked me with — 'Captain Kane, the lamp's out.' I heard him with a thrill of horror. The gale had increased; the cold was piercing, the darkness intense; our tinder had become moist, and was now like an icicle. All our fire-arms were stacked outside, for no Arctic man will trust powder in a condensing temperature. We did not dare to break down our doorway, for that would admit the gale; our only hope of heat was in re-lighting our lamp. Petersen, acting by my directions, made several attempts to obtain fire from a pocket pistol; but his only tinder was moss, and our heavily stone-roofed hut or cave would not bear the concussion of a rammed wad.

"By good luck I found a bit of tolerably dry paper in my jumper; and, becoming apprehensive that Petersen would waste our few percussion caps with his ineffectual snappings, I determined to take the pistol myself. It was so intensely dark that I had to grope for it, and in doing so touched his hand. At that instant the pistol became distinctly visible. A pale bluish light, slightly tremulous but not broken, covered the metallic parts of it, the barrel, lock, and trigger. The stock, too, was clearly discernible as if by the reflected light, and, to the amazement of both of us, the thumb and two fingers with which Petersen was holding it, the creases, wrinkles, and circuit of the nails clearly defined upon the skin. The phosphorescence was not unlike the ineffectual fire of the glow-worm. As I took the pistol my hand became illuminated also, and so did the powder-rubbed paper when I raised it against the muzzle.

"The paper did not ignite at the first trial, but, the light from it continuing, I was able to charge the pistol with difficulty, rolled up my paper into a cone, filled it with moss sprinkled over with powder, and held it in my hand while I fired. This time I succeeded in producing flame, and we saw no more of the phosphorescence. I do not stop for theory or argument to explain this

opportune phenomenon; our fur clothing and the state of the atmosphere may refer it plausibly enough to our electrical condition.

"As soon as the wind had partially subsided, we broke out of the hut and tried the dogs toward Refuge Inlet; but the poor broken-down animals could not surmount the hummocks; and, as a forced necessity to save their lives and ours, we resolved to push for the brig on foot, driving them before us. We made the walk of forty-four miles in sixteen hours, almost scudding before the gale, and arrived safely at 7 P. M. of Sunday; the temperature —40°."

With this fruitless adventure closed the year 1854.

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## IN FROBISHER BAY.

BY

CHARLES FRANCIS HALL.

This indomitable Arctic explorer was born in Rochester, N. H., in 1821, where he received a common-school education and became a blacksmith and an engraver. He fitted out an expedition which sailed from New London in 1860 to search for vestiges of the Franklin expedition; lived and traveled with the Esquimaux and returned in 1862 having failed in his purpose, but he found relics of Frobisher's expedition of 1577–8. He made a second journey in 1864–69 which was more successful, and with a third in 1871 succeeded in reaching the farthest point north then attained by any vessel. He afterward went into winter quarters in Thank God Harbor, Greenland, and died there.

IT WAS on Thursday morning, August 29th, 1861, when we made preparations to leave our twelfth encampment to cross over to the westward to Kingaite, along the head of the Bay of Frobisher. Before I proceed with my narrative, let me bring forward an extract from my journal written the evening previous:

"Indeed we are in a land and by waters of plenty. I am constantly overwhelmed with presents of the very best

From "Arctic Researches or Life Among the Esquimaux." New York.

of choice eating—tauktoo tongues, toodnoo, venison, ducks, seals, and salmon. Kooperneung this moment (8 P. M.) comes in saying that Koojesse is near by. *Now for the trip across the head of Frobisher bay to Kingaite side.* * * * * * 8:30 P. M. Koojesse has just arrived; brought four tuktoo skins, showing that he has killed as many reindeer. What a pity that such excellent meat as venison should be abandoned? He has seen nothing of Koodloo, who still remains out. The weather continues fine, and indications are every way favorable of its continuance."

Thursday morning Koodloo had not returned from his prolonged tuktoo hunt. Arrangements having been previously made with him that, in case he returned and found us gone, he should make his way over the land terminating Frobisher bay to Kingaite, where he would find us, we decided to strike tupics, pack boats, and push on. At 10:30 A. M. the two boats and two kias were under way, our course nearly due west, to a point of land called by the natives *Kou-mark-bing*—named by me Peale Point*—that shoots down abruptly some three miles from the most northerly extreme of Frobisher bay.

We soon passed an indentation in the coast of about three miles, at the head of which was a grassy plain, a little inclined from the water's edge to the hills that flank it, and extending back for about a mile. As we approached Peale Point I found it fringed with many islets, and, on arriving there, landed for making meridional observations. Peale Point consists of rugged rocks, which, though not of great height, are yet considerably more elevated than any part of the land at the head proper of Frobisher bay. Here we found on the sandy beach large and remarkable time-worn boulders, nearly white, and numerous tuktoo tracks. I noticed, also, the usual signs of Innuit encampments, such as circles of stones, bones of various animals, etc. On reaching the lower group of islands near the cape, Koojesse, who was in his kia, came alongside. I asked him, "*Nou-ti-ma?*"

* Named after Washington Peale, of New York City It is in lat. 63° 43′ 30″ N., long. 68° 33′ W.

—where now? He pointed toward a long island out of our regular course across the bay. I told him I wished and expected to go direct to the opposite side from our last encampment—to go to *Ag-goun,* the west side of the head of the bay. He replied that we could not get there, as the tide would be too low for the boat before arriving. I thought differently, and said I wished to go there and spend a day or two. He, however, seemed not disposed to please me, and remarked that I could see the whole head of the bay from the point where he desired to go. I answered that this would not do; *I must go where I wanted to.* If he wished to visit the point named, well and good; he might go there and spend the night, but on the morrow I must have him and the others proceed with me in the direction I wished. He agreed to this, though evidently considering it useless, so long as I could see the termination of the bay.

According to my original purpose, I thought it well to attempt to go back by the Kingaite side, that is, opposite to my upward route. At all events, I would endeavor to to get as far as the island Kikitukjua, Gabriel's island of Frobisher, which is not far from the locality where "Sampson" and his people were located during my visit to them in the previous winter. It is true that I had intended to revisit the coast on that side; but still enough had been done, with sufficient accuracy, for the civilized world to gain a knowledge of the general situation of Frobisher Bay. At least, the opinion that these waters are a strait ought not any longer to be entertained.

At 4 P. M., having made a distance of six miles from Peale's point on a course S. 40° W. true, we entered a channel, with Kingaite on our right and Bishop's island[1] at our left. The coast on each side was steep, but in many places covered with grass and the usual vegetation to be found here in the North. The entrance to this channel was about half a mile wide; but, on making a quarter of a mile, it brought us into a harbor that appeared to be a

[1]Thus named after R. M. Bishop, of Cincinnati, Ohio. The centre of this island, which bounds the north and eastern side of the harbor of the thirteenth encampment, is in lat. 63° 39′ N., long. 68° 35′ W.

fine one, not less than two and a half miles in diameter. Thence we passed on a course nearly south to the west side of the harbor, where we landed, and there made our thirteenth encampment on Kingaite.

Throughout this day, on approaching the islands or mainland, I noticed that the water seemed very shallow, and it was certain that no large-sized ships could attempt to reach the head of Frobisher bay with any degree of safety.

Before arriving at the place of our encampment, I saw the tupics of our other Innuit friends and the curling smoke of their fires. As I landed Koodloo greeted us. He had just come in from his hunt, having shot and secured skins and toodnoo of four deer. This made thirteen that my three men had killed within four days. On making up to our intended encampment, all hands commenced unloading the boat, the females, as was customary, acting as pack-horses in conveying everything up the steep rocks beyond reach of the tide; then they selected a convenient spot and erected the tupics.

A few moments after our arrival, with the "stars and stripes" of my country in one hand and my spyglass in the other, I made my way to the crest of a high hill in the rear of our encampment. Before starting, the sun was down — to us; but, as I reached the summit, his glorious rays burst upon me. And how glad was my heart as I planted the flag of America upon that mountain-top, and beheld it fluttering to the breezes of heaven in the sun's light. The red, white, and blue — the argent stars — seemed gifted with a speaking spirit that said, "God hath ever blessed, and ever will bless this emblem of freedom and power!" Yes, said I, mentally, that banner now floats where white man never stood before. The American flag precedes all others in proclaiming that this is the inceptive moment when civilization, with all its attendant virtues, makes hither its advance.

How soul-inspiring was the scene before me as, drinking in the sweets presented to my eyes, I wended my way from one mountain-top to another. It was night when I got back to our encampment, and I was immediately

greeted with two welcome presents of blueberries. Tweroong brought hers in a gold-banded china saucer. And a most strange sight it was, here amid the gray old rocks, and among this iron people, to see such an emblem of civilization as a tea-saucer. It was brim full of ripe, luscious berries, which were then very abundant.

On Saturday, August 31st, the weather was thick and foggy. In the morning I had a good wash with snow — not snow of this season, however. What its age was I know not; perhaps it belonged to many winters ago; but, notwithstanding, it was fresh and white, and it gave me clean, cool hands and face, which is a luxury in the North, as well as in any other place. By the side of this friendly snow-drift was abundant vegetation, green and fruitful, and blueberries all around. I picked some with rather cold, stiff fingers, and made a capital feast. I had not found any place where there was a greater variety of vegetable growth within the same space. In a little spot, not over four feet square, one could count more than fifty different kinds of vegetation. Mosses, grasses, berry-bushes, flowers, willows, and many other plants, could be enumerated as abounding in that little plot. But all these were quite diminutive; for instance, the blueberry-bushes were only from an inch to two inches in height.

On this day I made arrangements with Miner and Koojesse for the whole company in the boats and kias to return by the Kingaite side. It was agreed that we should proceed first to Aggoun — the Innuit name of the west side of the head of Frobisher bay — and thence return and follow down the coast of Kingaite. The chief reason for my making such an arrangement was that, by having two boats, should a mishap occur to one, the other would be our "Rescue."

We started from our thirteenth encampment in the afternoon, leaving behind two of the Innuit tents erect, and some sundries, to be called for on our return from Aggoun. Our course was direct for the northwest end of Bishop's Island, upon which I landed. From its top the whole head of Frobisher bay, from Sylvia Grinnell river, northeast side, to Aggoun, west side, was in view. It is

fourteen nautical miles across. The termination is not by deep bays or fiords, but by slight indentations, the greatest not exceeding three miles. Bishop's island was well covered with vegetation, especially with reindeer moss, the ground, in many parts, being quite carpeted with it.

As we descended the side-hill leading to the boat, I found the women busily engaged with their cups in blueberry picking, pulling them now and then by the handful, the berries were so large and abundant. Before long the party came on board, bringing with them quarts of the luscious fruit, with which they entertained us very agreeably, the whole scene carrying me back at once among the friends of my youth.

Innuits will always be Innuits. When we left our thirteenth encampment, one of them had gone off with his kia to an island to hunt some tuktoo, which had been seen two hours before. A part of the company had been left with the other boat to await the return of the deer-hunter, while the rest of us went on slowly, stopping at Bishop's island, as above related. We had but just re-embarked, when Koojesse, looking through his spyglass back toward the encampment, announced that the other party had a tuktoo in the water — a live tuktoo! This fired every Innuit; all the powers of reason could not keep them from going to see the fun; and so about we went, and in a moment they were all pulling back as for dear life. The sequel was more amusing and satisfactory to me than to my Innuits. When they came near enough to see their live tuktoo, it turned out to be only a goose!

After sundry other vexatious delays of a similar nature we were fairly under way, and the scene was for a time pretty indeed. The boats were alongside of each other. The Innuit women were at the oars. In the jacket-hood of Puto was her child, the constant, measured rock of the body in pulling the oar being equal for sleep-giving to any patent Yankee cradle ever invented. The gilt headbands of the ladies glittered and flashed, and the whole picture was peculiar and charming.

At about 6 P. M. we stopped for our fourteenth encamp-

ment,[1] the fog shutting us out from all view except of the coast on our left. The place where we encamped was on the Kingaite side of Frobisher bay, at the base of a long straight bank of sand and shingle, from thirty-five to forty feet high, the top being a grassy slope which extended back some three hundred fathoms to the mountains.

"September 1, 1861.—A day of trials and discovery. At last I am where I have long desired to be. From my own vision, 'Frobisher's strait' is a myth. It only exists in the minds of the civilized world — not in fact.

"I find this side still more interesting than the other. Here, at the west extreme, are far more extensive plains of grassy land than elsewhere. Koojesse has this moment passed to my hands what I think will prove to be rare geological specimens — fossils."

But let me give the day's occurrences in a methodical form; for I wrote the above, and much more in my diary while sitting on the rocks that are at the head of Frobisher bay, after several hours' severe labor.

The morning commenced thick and foggy, with occasional glimpses of finer weather. I ascended to the plain in the rear of the fourteenth encampment, at the top of the sand and shingle bank, and saw much vegetation, with numerous signs of reindeer in the neighborhood. Then I examined wherever I could; but my view was very limited, as numerous islands bounded the vision toward the bay. At low water frequent shoals are exposed, and even to navigate our boats thus far we had been obliged to wait for the tide at half flood.

When I desired to get under way, I found that Koojesse, without saying one word to me about it, had gone out on the mountains tuktoo hunting. Kooperneung had also taken Miner's kia, and had set out in advance after seals. Thus was I perpetually annoyed by the freaks and vagaries of this free and independent people. At last, however, at 1 P. M., we left our encampment and proceeded up the west side of the bay, toward its extreme head, called by the Innuits Aggoun.

[1] Our fourteenth encampment was in lat. 63° 41′ N., long. 68° 48′ W.

I had a boat's crew of women; for Koodloo, who had frequently proved himself a lazy dog, sat in the bow with his oar peaked, leisurely reclining on his thwart. Having gone for some time in a northwesterly direction, I turned the boat toward the shore (Kingaite side), intending to land and visit a remarkable ridge of what seemed to be sand, stretching a mile or so along the coast. Before getting near the shore, though, I could see that the water was becoming very shallow, the bottom being of fine sand, and the boat soon grounded. As I could not make a landing, I concluded to push on, for I felt sure that we were very near the termination of Frobisher bay. I reckoned without my host, however, in thinking to get on without trouble. The Innuits of my boat looked back to the craft of "Miner," and declared that the latter was making an encampment about a mile behind. I found the crew bent on going thither, but I was determined this should not be. I asked Suzhi, "Noutima Aggoun?"—where is Aggoun? She pointed to where Miner was. I knew this to be but a trick to get me back. I felt that I could manage women at least, and cried out "A-choot!"—pull ahead—returning a decided negative to their prayers to go back. With some difficulty I brought them to their working senses.

Finally we reached the estuary of a river—Jordan's river,[1] as I have named it—and, after crossing it, landed on its eastern side. We were then obliged to wade quite a distance to the shore proper through mud that was nearly knee deep. On a small grass-plat of Hazard's banks[2] we made our fifteenth encampment.

Leaving the Innuits to unload the boat, I started off on a tramp of discovery, and continued my course up the river, which at first ran in a northwest direction, and then, for a short distance, more northerly. As I walked along, charmed with the prospect before me, I came across a skull, which I took up for the purpose of ascertaining from the Innuits to what animal it belonged. I afterward found that it was that of a white whale. I saw

[1] Named after Daniel B. Jordan, of Cincinnati, Ohio.

[2] The land on the east side of the estuary of Jordan's River I have named after Charles S. Hazard, of New York City.

around me, as I advanced, that vegetation was abundant, and signs of animal life were very numerous. As I rounded a rocky eminence by the river side, at a distance of a mile from where I had left the boat, a beautiful cascade, at the head of tide-water, was before me, and at its base a little sheet of water nearly covered with Brent geese.

From this point an extensive and picturesque scene burst upon my view. Before me were long and wide plains, meadows of grass, smoothly-sloping hills, and a range of mountains beyond, which, parting in one particular spot, formed, as it were, a natural gateway, that might almost lead, in fancy, to some fairy land beyond. At my left, across the river, was a ridge of white, which I afterward named Silliman's Fossil mount,[1] and behind it the unbroken front of a line of mountains extending northwesterly to the opening which I have called the Great Gateway. On the other, or northern side, the mountains continued from this singular opening on by Frobisher bay to the locality around Field bay, far to the southwest and eastward. Flocks of little chirping birds greeted me at every turn, and nowyers and ducks were in numbers before my eye. Words cannot express my delight, in view of this scene, as I stood by the waterfall, beholding its white spray, and the clear, limpid stream of the river.

The fall is about twenty-five feet in three or four rods, and at no place over four feet descent at once. The river is not so large as the Sylvia Grinnell, and yet, though the season is evidently a dry one, much water flows along, and at certain portions of the year this stream must discharge a large quantity. The banks in some places are of fine sand, and in others, farther up, of ledges of rocks that are from fifty to sixty feet high. I wandered about for two hours, and then returned to our camp.

Miner's boat was out at the time, but I soon saw it approaching at great speed, its crew shouting lustily. In a

[1] Thus named after Benjamin Silliman, Jr., of New Haven, Conn. This fossil mount is on the west side of the termination of Frobisher bay.

moment I perceived the cause of their excitement. A white whale was swiftly making its way through the waters toward the main bay. The Innuits were after it, and their shouting voices made the neighborhood ring again; but it escaped, and the boat came to our encampment, the occupants in no good humor. One of the men, Charley, clearly proved this. His wife was helping to unload the boat, and had to walk through deep mud with a heavy load upon her shoulder. Suddenly, for some unknown cause, Charley, with great force, threw his sealhook directly at her. It caught in her jacket. Turning round, she calmly took it out, and then walked on again. It was a cruel act of the man, but these Innuits always summarily punish their wives for any real or imaginary offense. They seize the first thing at hand — a stone, knife, hatchet, or spear — and throw it at the offending woman, just as they would at their dogs.

Two of our party were still absent. Koojesse, however, made his appearance on the opposite side of the river, and it was necessary to send the kia to fetch him off. Now a kia has but one hole in its covering for the person who uses it; therefore, if a second person is to be carried anywhere, he or she must take a position directly behind the other occupant, lying flat on the face, perfectly straight and still. It was in this manner that Koojesse, and afterward Toolookaah, were brought off.

I had another walk up to the falls, and again the scene appeared to me as one of the most beautiful I had ever beheld. I felt like those old Icelanders who visited the regions west of them, and, because of more verdure seen than in their own country, exclaimed, "This is Greenland!" In the present case, my feeling was that no more appropriate name could be given to the district before me than "Greenwood's Land," in honor of Miles Greenwood, of Cincinnati, Ohio. I think no one, not even an English geographer, will question my right to name this land. At the head of Frobisher bay — now positively determined to be such, and no longer a "strait" — exists this beautiful and fertile district, and I considered the name of Greenwood to be especially appropriate.

"MEN OF PROGRESS"

FROM AN ENGRAVING PUBLISHED BY "THE SCIENTIFIC AMERICAN" IN 1861

*Top row left of centre:*

Jas. Bogardus — Iron Buildings.
Samuel Colt — Fire Arms.
Joseph Saxton — Fine Machinery.
Peter Cooper — Organizing of Manufacture.
Prof. Henry — Electro-Magnetism.

*Top row right of centre:*

John Ericsson — Marine Engineering.
S. F. B. Morse — Telegraph.
Richard Hoe — Rotary Press.
Erastus Bigelow — Carpet Loom.
Thos. Blanchard — Eccentric Lathe.

*Lower row left of centre:*

Dr. Morton — Anaesthesia
C. H. McCormick — Harvesting Mach.
Chas. Goodyear — Vulcanized Rubber.
J. L. Mott — Iron Work.

*Lower row right of centre:*

Dr. Nott — Heating of Bldgs.
F. E. Sickles — Steam Engines.
Henry Burden — Iron Working.
Jennings — Friction Matches.
Elias Howe — Sewing Machines.

# PROGRESS OF INVENTIONS.

A list of important inventions in chronological order beginning with the 16th century, with the title of the invention, the year it was made, the name of the inventor and his nativity:

| Inventions. | Date. | Inventor. | Nativity. |
|---|---|---|---|
| Discoveries of electrical phenomena | 1560 | William Gilbert | England |
| Won the title of "founder of the science of electricity." | 1603 | | |
| Screw printing-press | 1620 | | |
| Spirally grooved rifle barrel | 1620 | Blaew | Germany |
| Iron furnaces | 1621 | Koster | England |
| The use of steam | 1630 | Lord Dudley | England |
| The first authentic reference in English literature to the use of steam in the arts. | | David Ramseye | England |
| Bay Psalm Book, first book published in the Colonies | 1640 | | Mass. |
| Barometer | 1643 | Torricelli | Italy |
| Steam engine, atmospheric pressure | 1663 | Thomas Newcomen | England |
| Machine for generating electricity | 1681-6 | Otto von Guericke | Germany |
| First paper mill in America | 1690 | William Rittenhouse | Penna. |
| First steam engine with a piston | 1690 | Denys Papin | France |
| The manufacture of plate glass established | 1695 | | France |
| First to discover difference between electric conductors and insulators | 1696 | Stephen Gray | England |
| | 1736 | | |
| The first practical application of the steam engine | 1702 | Thomas Savery | England |
| First Newspaper in America, "Boston News Letter" | 1704 | John Campbell | Mass. |
| First to produce electric spark | 1708 | Dr. J. Ward | England |
| | 1716 | | |
| Thermometer | 1709 | Fahrenheit | Danzig |
| Electrometer, the well-known pith ball | 1718 | John Cantor | England |
| | 1772 | | |
| The "Franklin" printing-press | 1725 | Benjamin Franklin | U. S. |
| Electrical glass plate machine | 1727 | Martin de Planta | France |
| | 1772 | | |
| Stereotyping | 1731 | William Ged | Scotland |
| First to discover that electricity is of two kinds | 1733-9 | Cisternay du Fay | France |
| Flying shuttle in weaving | 1733 | John Kay | England |
| Rotary 3-color printing-press (multi-color) | 1743 | Platt & Keen | England |
| Electric or Leyden Jar | 1745 | Kleist | Germany |
| Substitution of coke for coal in melting iron | 1750 | Abraham Darby | England |
| Lightning conductor | 1752 | Benjamin Franklin | U. S. |
| Spinning jenny | 1763 | James Hargreaves | England |
| Pianoforte, played in public in England in | 1767 | | England |
| Drawing rolls in a spinning machine | 1769 | Richard Arkwright | England |
| The introduction of the "Hollander" or beating engine for pulping rags in the manufacture of paper | 1773 | | |
| The mule spinner | 1774 | Samuel Crampton | England |
| Cut nails | 1775 | Jeremiah Wilkinson | U. S. |
| Circular wood saw | 1777 | Miller | England |
| Embryo bicycle | 1779 | Branchard & Magurier | France |
| Steam engine, the basis of the modern engine | 1782 | James Watt | Scotland |
| Gas balloon | 1783 | J.E. & J. M. Montgolfier | France |
| Puddling iron | 1783-4 | Henry Cort | England |
| Plow, with cast-iron mold board, and wrought and cast-iron shares | 1784 | James Small | Scotland |
| Power loom | 1785 | James Cartwright | England |
| First steamboat in the United States | 1786 | John Fitch | U. S. |
| Steam road wagon (first automobile) | 1787 | Oliver Evans | U. S. |
| Grain threshing machine | 1788 | Andrew Meikle | England |
| Hobby horse, forerunner of bicycle | 1790 | | England |
| Rotary steam power printing-press, the first idea of | 1790 | Wm. Nicholson | England |
| Wood planing machine | 1791 | Samuel Bentham | England |

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## PROGRESS OF INVENTIONS — *Continued.*

| Inventions. | Date. | Inventor. | Nativity. |
|---|---|---|---|
| Gas first used as an illuminant | 1792 | Wm. Murdoch | England |
| Cotton gin | 1794 | Eli Whitney | U. S. |
| Art of lithography | 1796 | Alois Senefelder | Germany |
| Machine for making continuous webs of paper | 1800 | Louis Robert | France |
| Electric battery discovered | 1800 | Volta | Italy |
| Steam coach | 1801 | Richard Trevithick | England |
| Wood mortising machine | 1801 | M. J. Brunel | England |
| Pattern loom | 1801 | M. J. Jacquard | France |
| First fire-proof safe | 1801 | Richard Scott | England |
| Steamboat on the Clyde, "Charlotte Dundas" | 1802 | William Symington | England |
| First photographic experiments | 1802 | Wedgwood & Davy | England |
| Planing machine | 1802 | J. Bramah | England |
| The application of steam to the loom | 1803 | William Horrocks | England |
| Steel pen | 1803 | Wise | England |
| Steam locomotive on rails | 1804 | Richard Trevithick | England |
| Application of twin-screw propellers in steam navigation | 1804 | John Stevens | U. S. |
| Process of making malleable-iron castings | 1804 | Lucas | England |
| First life preserver | 1805 | John Edwards | England |
| Electro-plating | 1805 | Luigi Brugnatelli | Italy |
| Knitting machine, the latch needle in the | 1806 | Jeandeau | France |
| Steamboat navigation on the Hudson River | 1807 | Robert Fulton | U. S. |
| Percussion or detonating compound | 1807 | A. J. Forsyth | Scotland |
| First street gas lighting in England | 1807 | F. A. Winsor | England |
| Band wood saw | 1808 | Newberry | England |
| Voltaic arc | 1808 | Sir Humphry Davy | England |
| First steamboat to make a trip to sea, the "Phœnix" | 1808 | John Stevens | U. S. |
| Multi-wire telegraphy | 1809 | Sommering | Germany |
| Revolving cylinder printing-press | 1810 | Frederick Koenig | Germany |
| Breech-loading shotgun | 1811 | Thornton & Hall | U. S. |
| Storage battery | 1812 | J. B. Ritter | Germany |
| Dry pile (prototype of dry battery) | 1812 | Zamboni | Italy |
| First practical steam rotary printing-press, paper printed on both sides | 1814 | Frederick Koenig | Germany |
| First locomotive in United States | 1814 | George Stephenson | England |
| First circular wood saw made in this country | 1814 | Benjamin Cummings | U. S. |
| Heliography | 1814 | Jos. N. Niepce | France |
| Kaleidoscope | 1814 | Sir David Brewster | England |
| Miners' safety lamp | 1815 | Sir Humphry Davy | England |
| Dry gas meter | 1815 | S. Clegg | England |
| Knitting machine | 1816 | Brunel | England |
| "Draisine" bicycle | 1816 | Baron von Drais | Germany |
| "Columbian" press, elbowed pulling bar, number of impressions per hour, 50 | 1817 | George Clymer | U. S. |
| Stethoscope | 1819 | Laënnec | France |
| Electro-magnetism discovered | 1819 | H. C. Oersted | Denmark |
| Lathe for turning irregular wood forms | 1819 | Thomas Blanchard | U. S. |
| The theory of electro-dynamics first propounded | 1820 | Andre Ampère | France |
| Electroscope | 1820 | Bohenberg | Germany |
| The conversion of the electric current into mechanical motion | 1821 | Michael Faraday | England |
| Galvanometer | 1822 | Schweigger | Germany |
| Multi-color printing | 1822 | P. Force | U. S. |
| Calculating machine | 1822 | Charles Babbage | England |
| Discovery of thermo-electricity | 1823 | Prof. Seebeck | England |
| Liquefaction and solidification of gas | 1823 | Michael Faraday | England |
| Water gas, discovery of | 1823 | Ibbetson | England |
| Portland cement | 1825 | Joseph Aspdin | England |
| Electro-magnet | 1825 | Sturgeon | England |
| First passenger railway, opened between Stockton and Darlington, England | 1825 | | |
| Electrical spur wheel | 1826 | Barlow | England |
| First railroad in United States, near Quincy, Mass | 1826 | | |
| The law of galvanic circuits formulated | 1827 | George S. Ohm | Germany |
| Friction matches | 1827 | John Walker | U. S. |
| The reduction of aluminum | 1827 | Friedrich Wohler | Germany |
| Law of electrical resistance | 1827 | George S. Ohm | Germany |
| Improved rotary printing-press, London Times, 5,000 impressions per hour | 1827 | Cowper & Applegarth | England |
| Hot air blast for iron furnaces | 1828 | J. B. Neilson | Scotland |

## PROGRESS OF INVENTIONS — *Continued.*

| Inventions. | Date. | Inventor. | Nativity. |
|---|---|---|---|
| Wood planing machine | 1828 | William Woodworth | U. S. |
| Spool electro-magnet | 1828 | Joseph Henry | U. S. |
| Tubular locomotive boiler | 1828 | Séquin | France |
| Spinning ring frame | 1828 | John Thorp | England |
| The "Washington" printing-press, lever motion and knuckle joint for a screw, number of impressions per hour, 200 | 1829 | Samuel Rust | U. S. |
| First steam locomotive in United States, "Stourbridge Lion" | 1829 | | |
| Double fluid galvanic battery | 1829 | A. C. Becquerel | France |
| First portable steam fire engine | 1830 | Brathwaite & Ericsson | England |
| Magneto-electric induction | 1831 | Michael Faraday | England |
| Chloroform | 1831 | G. J. Guthrie | Scotland |
| First conception of electric telegraph | 1832 | Prof. S. F. B. Morse | U. S. |
| First magneto-electric machines | 1832 | Saxton | U. S. |
| Rotary electric motor | 1832 | Wm. Sturgeon | England |
| Chloral-hydrate | 1832 | Justus von Liebig | Germany |
| Locomotive, "Old Ironsides," built | 1832 | M. W. Baldwin | U. S. |
| Link motion for locomotives | 1832 | Sir Henry James | England |
| Adoption of steam whistle for locomotives | 1833 | George Stephenson | England |
| Reciprocating saw-tooth cutter within double guard fingers for reapers | 1833 | Obed Hussey | U. S. |
| "McCormick" reaper | 1834 | Cyrus H. McCormick | U. S. |
| Rotary electric motor | 1834 | M. H. Jacobi | Russia |
| Carbolic acid discovered | 1834 | Runge | Germany |
| Horseshoe machine | 1835 | H. Burden | U. S. |
| Constant electric battery | 1836 | J. F. Daniell | England |
| Acetylene gas discovered | 1836 | Edmund Davy | England |
| The revolver; a device "for combining a number of long barrels so as to rotate upon a spindle by the act of cocking the hammer" | 1836 | Samuel Colt | U. S. |
| The screw applied to steam navigation | 1836<br>1841 | John Ericsson | U. S. |
| The galvanizing of iron | 1837 | Henry Craufurd | England |
| Indicator-telegraph | 1837 | Cooke & Wheatstone | England |
| Photographic carbon printing | 1838 | Mungo Ponton | France |
| Babbitt metal | 1839 | Isaac Babbitt | U. S. |
| Vulcanization of rubber | 1839 | Charles Goodyear | U. S. |
| The first boat electrically propelled | 1839 | Jacobi | Germany |
| Daguerreotype (First to produce a direct photographic positive in the camera by means of highly polished silver surfaced plate exposed to the vapors of iodine and subsequent development with mercury vapor.) | 1839 | Louis Daguerre | France |
| Making photo-prints from paper negatives. (First production of positive proofs from negatives.) | 1839 | Fox Talbot | England |
| Photographic portraits (Daguerreotype process) | 1839 | Profs. Draper & Morse | U. S. |
| First incandescent electric lamp | 1840 | Grove | England |
| Celestial photography | 1840 | Draper | U. S. |
| Artesian well | 1840 | | Paris |
| Pneumatic caissons | 1841 | M. Triger | France |
| Pianoforte automatically played | 1842 | M. Seytre | France |
| Water gas, utilization of | 1842 | Selligne | France |
| Steam hammer | 1842 | James Nasmyth | Scotland |
| Typewriting machine | 1843 | Charles Thurber | U. S. |
| First telegram sent | 1844 | Prof. S. F. B. Morse | U. S. |
| The use of nitrous oxide gas as an anæsthetic | 1844 | Dr. Horace Wells | U. S. |
| The electric arc light (gas retort carbon in a vacuum) | 1844 | Léon Foucault | France |
| First telegraphic message, Washington, Baltimore | 1844 | Prof. S. F. B. Morse | U. S. |
| Automatic adjustment of electric arc light carbons | 1845 | Thomas Wright | England |
| Double cylinder printing-press | 1845 | R. Hoe & Co. | U. S. |
| Pneumatic tire | 1845 | R. W. Thompson | England |
| Sewing machine | 1846 | Elias Howe | U. S. |
| Printing telegraph | 1846 | House | U. S. |
| Suez canal started | 1846 | De Lesseps | France |
| Ether as an anæsthetic | 1846 | Dr. Morton | U. S. |
| Electric cautery | 1846 | Crusell | Russia |
| Artificial limbs | 1846 | | |

## PROGRESS OF INVENTIONS—*Continued.*

| Inventions. | Date. | Inventor. | Nativity. |
|---|---|---|---|
| Gun cotton | 1846 | Schönbein | Germany |
| First pianoforte keyboard player | 1846 | Debain | France |
| Chloroform in surgery | 1847 | Dr. Simpson | Scotland |
| Nitro-glycerine | 1847 | Sobrero | |
| Time-lock | 1847 | Savage | U. S. |
| Hoe's lightning press, capable of printing 20,000 impressions per hour | 1847 | Richard M. Hoe | U. S. |
| Match-making machinery | 1848 | A. L. Dennison | U. S. |
| Breech gun-lock, interrupted thread | 1849 | Chambers | U. S. |
| Magazine gun | 1849 | Walter Hunt | U. S. |
| Steam pressure gauge | 1849 | Bourdon | France |
| Lenticular stereoscope | 1849 | Sir David Brewster | England |
| Latch needle for knitting machine | 1849 | J. T. Hibbert | U. S. |
| "Corliss" engine | 1849 | G. H. Corliss | U. S. |
| Printing-press, curved plates secured to a rotating cylinder | 1849 | Jacob Worms | France |
| Mercerized cotton | 1850 | John Mercer | England |
| Collodion process in photography | 1850 | Scott Archer | England |
| American machine-made watches | 1850 | | U. S. |
| Electric locomotive | 1851 | Dr. Page | U. S. |
| Self-raker for harvesters | 1851 | W. H. Seymour | U. S. |
| Breech-loading rifle | 1851 | Maynard | U. S. |
| Icemaking machine | 1851 | J. Gorrie | U. S. |
| Opthalmoscope | 1851 | Helmholtz | Germany |
| The Ruhmkorff coil | 1851 | Ruhmkorff | Germany |
| Fire-alarm telegraph | 1852 | Channing & Farmer | U. S. |
| Reticulated screen for half-tone photographic printing | 1852 | Fox Talbot | England |
| Soda process of making pulp from wood | 1853 | Watt & Burgess | U. S. |
| Laws of magneto-electric induction | 1853 | Michael Faraday | England |
| Laws of electro-statics | 1853 | Michael Faraday | England |
| Electrolysis | 1853 | Michael Faraday | England |
| Duplex telegraph | 1853 | Gintl | Austria |
| Photographic roll films | 1854 | Melhuish | England |
| Diamond rock drill | 1854 | Herman | U. S. |
| Four-motion feed for sewing machines | 1854 | A. B. Wilson | U. S. |
| Magazine firearm | 1854 | Smith & Wesson | U. S. |
| Fat decomposed by water or steam at high temperature, since largely used in soap making | 1854 | R. A. Tilghman | U. S. |
| Safety matches | 1855 | Lundstrom | Sweden |
| Iron-clad floating batteries first used in Crimean war | 1855 | | |
| Cocaine | 1855 | Gaedeke | Germany |
| Process of making steel, blowing air through molten pig iron | 1855 | Sir Henry Bessemer | England |
| Dryplate photography | 1855 | Dr. J. M. Taupenot | |
| Bicycle | 1855 | Ernst Michaux | France |
| Sleeping car | 1856 | Woodruff | U. S. |
| Aniline dyes | 1856 | Perkins | England |
| Printing machine for the blind (contains elements of the present typewriting machine). | 1856 | Alfred E. Beach | U. S. |
| Regenerative furnace | 1856 | Wm. Siemens | England |
| Refining engine in paper pulp making | 1856 | T. Kingsland | U. S. |
| Coal-oil first sold in the United States | 1857 | Messrs. Stout & Hand | U. S. |
| First sea-going iron-clad war vessel, the "Glorie" | 1857 | | France |
| Ground wood pulp | 1858 | Henry Voelter | Germany |
| Inclined elevator and platform in the reaper | 1858 | J. S. Marsh | U. S. |
| Cable car | 1858 | E. A. Gardner | U. S. |
| Breech-loading ordnance | 1858 | Wright & Gould | U. S. |
| Feed injector for boilers | 1858 | Giffard | France |
| First Atlantic cable | 1858 | Cyrus Field | U. S. |
| Great Eastern launched | 1859 | | |
| Storage or secondary battery | 1860 | Gaston Planté | France |
| Singing telephone | 1860 | Philip Reis | Germany |
| Ammonia absorption ice machine | 1860 | F. P. E. Carré | France |
| Improved stereotyping process | 1861 | Charles Craske | U. S. |
| Shoe-sewing machine | 1861 | George McKay | U. S. |
| Driven well, a tube with a pointed perforated end driven into the ground | 1861 | Col. N. W. Green | U. S. |
| Passenger elevator | 1861 | E. G. Otis | U. S. |
| Barbed-wire fence introduced | 1861 | | U. S. |
| Calcium carbide produced | 1862 | Frederich Woehler | Germany |

## PROGRESS OF INVENTIONS — *Continued.*

| Inventions. | Date. | Inventor. | Nativity. |
|---|---|---|---|
| Revolving turret for floating battery | 1862 | Theodore Timby | U. S. |
| First iron-clad steam battery, "Monitor" | 1862 | John Ericsson | U. S. |
| Gatling gun | 1862 | Dr. R. J. Gatling | U. S. |
| Smokeless gunpowder | 1863 | J. F. E. Schultze | Prussia |
| Pneumatic pianoforte player (regarded as first to strike keys by pneumatic pockets). | 1863 | M. Fourneaux | France |
| Explosive gelatine | 1864 | A. Nobel | France |
| Rubber dental plate | 1864 | J. A. Cummings | U. S. |
| Automatic grain-binding device | 1864 | Jacob Behel | U. S. |
| Process of making fine steel | 1865 | Martin | U. S. |
| Antiseptic surgery | 1865 | Sir Joseph Lister | England |
| Web-feeding printing-press | 1865 | William Bullock | U. S. |
| Automatic shell ejector for revolver | 1865 | W. C. Dodge | U. S. |
| Open-hearth steel process | 1866 | Siemens-Martin | England |
| Compressed air rock drill | 1866 | C. Burleigh | U. S. |
| Torpedo | 1866 | Whitehead | U. S. |
| Dynamo electric machine | 1866 | Wilde | England |
| Dynamo electric machine | 1866 | Siemens | Germany |
| Sulphite process for making paper pulp from wood | 1867 | Tilghman | U. S. |
| Disappearing gun carriage | 1868 | Moncrief | England |
| First practical typewriting machine | 1868 | C. L. Sholes | U. S. |
| Dynamite | 1868 | A. Nobel | France |
| Oleomargarine | 1868 | H. Mege | France |
| Water heater for steam fire engine | 1868 | W. A. Brickell | U. S. |
| Sulky plow | 1868 | B. Slusser | U. S. |
| Railway air-brake | 1869 | George Westinghouse | U. S. |
| Tunnel shield (operated by hydraulic power). | 1869 | Alfred E. Beach | U. S. |
| A curved spring tooth harrow | 1869 | David L. Carver | U. S. |
| Dynamo-electric machine | 1870 | Gramme | France |
| Celluloid | 1870 | J. W. & Isaac Hyatt | U. S. |
| Rebounding gun-lock | 1870 | L. Hailer | U. S. |
| The Goodyear welt shoe-sewing machine | 1871 | Goodyear | U. S. |
| Photographic gelatino-bromide emulsion (basis of present rapid photography) | 1871 | R. L. Maddox | England |
| Continuous web printing-press | 1871 | Hoe & Tucker | U. S. |
| Grain binder | 1871 | S. D. Locke | U. S. |
| Compressed air rock drill | 1871 | S. Ingersoll | U. S. |
| Positive motion weaving loom | 1872 | J. Lyall | U. S. |
| Theory that light is an electric phenomenon. | 1872 | Clerk Maxwell | England |
| Automatic air brake | 1872 | George Westinghouse | U. S. |
| Automatic car coupler | 1873 | E. H. Janney | U. S. |
| The photographic platinotype process. (Prints by this process are permanent.) | 1873 | Willis | England |
| Quadruplex telegraph | 1873 | T. A. Edison | U. S. |
| Twine binder for harvesters | 1873 | M. L. Gorham | U. S. |
| Gelatino-bromide photographic emulsion (sensitiveness to light greatly increased by the application of heat) | 1873 | Charles Bennett | England |
| Self-binding reaper | 1873 | Locke & Wood | U. S. |
| Barbed-wire machine | 1874 | Glidden & Vaughan | U. S. |
| Siphon recorder for submarine telegraphs | 1874 | Sir William Thompson | England |
| Store cash carrier | 1875 | D. Brown | U. S. |
| Illuminating water gas | 1875 | T. S. C. Lowe | U. S. |
| Roller flour mills | 1875 | F. Wegmann | U. S. |
| Middlings purifier for flour | 1875 | Geo. T. Smith | U. S. |
| Ice-making machine | 1875 | R. P. Pictet | Switzerl'd |
| Speaking telephone | 1876 | Alex. G. Bell | U. S. |
| Electric candle (The first step towards the division of the electric current for lighting.) | 1876 | Paul Jablochkoff | Russia |
| Continuous machine for making tobacco cigarettes | 1876 | Russell | U. S. |
| Steam feed saw mills | 1876 | D. C. Prescott | U. S. |
| The first Portland cement plant in U. S. | 1876 | ..... | Coplay, Pa |
| Phonograph | 1877 | T. A. Edison | U. S. |
| Gas engine | 1877 | N. A. Otto | U. S. |
| Carbon microphone | 1877 | T. A. Edison | U. S. |
| Telephone transmitter of variable resistance. | 1877 | Emil Berliner | U. S. |
| Carbon filament for electric lamp (Beginning of the incandescent vacuum electric light.) | 1878 | T. A. Edison | U. S. |
| Rotary disk cultivator | 1878 | Mallon | U. S. |
| Decided advance in the "expression" of self-playing pianofortes | 1878 | Gally | U. S. |

PROGRESS OF INVENTIONS — *Continued.*

| Inventions. | Date. | Inventor. | Nativity. |
|---|---|---|---|
| Automatic grain binder | 1879 | J. F. Appleby | U. S. |
| Cathode rays discovered | 1879 | Sir Wm. Crookes | England |
| Electric railway | 1879 | Siemens | Germany |
| Steam plow | 1879 | W. Foy | U. S. |
| Magazine rifle | 1879 | Lee | U. S. |
| "Blake" telephone transmitter | 1880 | Blake | U. S. |
| Hammerless gun | 1880 | Greener | U. S. |
| Storage battery or accumulator | 1880 | Camille A. Faure | France |
| Typhoid bacillus isolated | 1880 | Eberth & Koch | Germany |
| Pneumonia bacillus isolated | 1880 | Sternberg | U. S. |
| Button-hole machine | 1881 | Reece | U. S. |
| Hand photographic camera for plates | 1881 | Wm. Schmid | U. S. |
| Improvement in "expression" of self-playing pianofortes | 1882 | Schmaele | U. S. |
| Tuberculosis bacillus isolated | 1882 | Robert Koch | Germany |
| Hydrophobia bacillus isolated | 1882 | Louis Pasteur | France |
| Cholera bacillus isolated | 1884 | Robert Koch | Germany |
| Diphtheria bacillus isolated | 1884 | Loeffler | Germany |
| Lockjaw bacillus isolated | 1884 | Nicolaier | France |
| Antipyrene | 1884 | Kuno | U. S. |
| Linotype machine | 1884 | Ottmar Mergenthaler | Germany |
| The rear-driven chain safety bicycle | 1884 | George W. Marble | U. S. |
| Chrome tanning of leather | 1884 | Schultz | U. S. |
| Process of reducing aluminum | 1885 | Cowles | England |
| Gas burner | 1885 | Carl Welsbach | Germany |
| Hydraulic dredge | 1885 | Bowers | U. S. |
| First electric railway in United States, Hampden and Baltimore, Md | 1885 | | |
| Contact device for overhead electric trolley | 1885 | C. J. Van Depoele | U. S. |
| Graphophone | 1886 | Bell & Tainter | U. S. |
| Electric welding | 1886 | Elihu Thompson | U. S. |
| Combined harvester and thresher | 1886 | Matteson | U. S. |
| Band wood saw | 1887 | D. C. Prescott | U. S. |
| Cyanide process of obtaining gold and silver | 1887 | McArthur & Forrest | U. S. |
| System of polyphase electric currents | 1887 | Nicola Tesla | U. S. |
| Incandescent gas light (The formation of a cone-shaped interwoven mantle of thread coated with a refractory rare earth and rendering the same incandescent by the heat rays of a Bunsen gas burner regardless of how the gas is produced.) | 1887 | Carl A. Von Welsbach | Austria |
| Process of annealing armor plate | 1888 | Harvey | U. S. |
| "Kodak" snap-shot camera (Constructed to use a continuous sensitized ribbon film.) | 1888 | Eastman & Walker | U. S. |
| Process of making artificial silk | 1888 | H. DeChardonnet | France |
| Hertzian waves or electric-wave radiation | 1888 | Heinrich Hertz | Germany |
| First rotary cement kilns in U. S | 1889 | | Coplay, Pa |
| Nickel steel | 1889 | Schneider | U. S. |
| Process for making aluminum | 1889 | Chas. M. Hall | U. S. |
| Electric plow | 1890 | W. Stephens | U. S. |
| Improved linotype machine | 1890 | Ottmar Merganthaler | Germany |
| Bicycles equipped with pneumatic tires | 1890 | | |
| Krag-Jörgensen magazine rifle | 1890 | Krag-Jörgensen | U. S. |
| "Coherer" for receiving electric waves | 1891 | Edouard Branly | England |
| Rotary steam turbine | 1891 | C. A. Parsons | England |
| Cement-lined paper-pulp digester | 1891 | G. F. Russell | U. S. |
| Round bale cotton press | 1891 | Brown | U. S. |
| Microphone | 1891 | Emile Berliner | U. S. |
| Power loom | 1891 | Northrup | U. S. |
| Commercial application of formic-aldehyde | 1892 | J. J. A. Trillat | France |
| Shoe-last lathe, for different lengths | 1893 | Kimball | U. S. |
| Kinetoscope | 1893 | T. A. Edison | U. S. |
| Process for making carborundum | 1893 | E. G. Acheson | U. S. |
| Calcium carbide produced in electric furnace | 1893 | Thos. L. Willson | U. S. |
| Process for liquefying air | 1895 | Carl Linde | Germany |
| Electric locomotive, B. & O. Bell Tunnel | 1895 | | U. S. |
| X-rays | 18 5 | Prof. W. C. Roentgen | Germany |
| Acetylene gas from calcium carbide | 1895 | Thos. L. Wilson | U. S. |
| System of wireless telegraphy | 1896 | G. Marconi | Italy |
| Foundation laid of science of radio-activity, i. e., emanation of penetrating rays from luminescent bodies | 1896 | Henri Becquerel | France |
| Use of ultra-violet rays in treating diseases | 1896 | Niels R. Finsen | Denmark |

PROGRESS OF INVENTIONS — *Continued.*

| Inventions. | Date. | Inventor. | Nativity. |
|---|---|---|---|
| Nernst electric light. (Method of rendering a clay compound capable of conducting electricity and thence becoming brilliantly incandescent without a vacuum.) | 1897 | Walter Nernst | Germany |
| Mercury vapor electric light. (An artificial light composed strictly of the ultra blue violet rays of the spectrum obtained by passing an electric current through a partial vacuum tube filled with mercury vapor, the latter acting as a conductor. Possesses remarkable actinic power for photographic purposes.) | 1900 | Peter Cooper Hewitt | U. S. |
| Air-ship | 1901 | M. Santos-Dumont | France |
| Automobile mower | 1901 | Deering Harvester Co. | U. S. |
| The first passenger steam turbine ship, "Edward VII." | 1901 | Denny & Brothers | England |
| The first oil-burning steamship built in the United States, "Nevada" | 1902 | | |
| English Pacific cable, Canada-Australia | 1902 | | |
| American Pacific cable | 1903 | | U. S. |
| Berlin-Zossen Road, 130½ miles an hour | 1903 | | Germany |
| Wireless telegraphy greatly extended | 1903-6 | Various | Various |
| Wireless telephony | 1905 | I. A. Fessenden | U. S. |
| Electric furnace for refining steel | 1905 | Paul L. T. Heroult | France |
| Production of seedless fruit largely developed | 1903-5 | Luther Burbank | U. S. |
| Completion of the Simplon tunnel | 1905 | | Swiss and Italian |
| Zambezi River Bridge at Victoria Falls completed | 1905 | | England |

## SOME DISTINGUISHED AMERICAN INVENTORS.

Benjamin Franklin; b. Boston, 1706; d. 1790; at 12, printer's apprentice, fond of useful reading; 27 to 40, teaches himself Latin, etc., makes various useful improvements; at 40, studies electricity; 1752, brings electricity from clouds by kite, and invents the lightning rod.

Eli Whitney, inventor of the cotton-gin; b. Westborough, Mass., 1765; d. 1825; went to Georgia 1792 as teacher; 1793, invents the cotton-gin, prior to which a full day's work of one person was to clean by hand one pound of cotton; one machine performs the labor of five thousand persons; 1800, founds Whitneyville, makes firearms, by the interchangeable system for the parts.

Robert Fulton; b. Little Britain, Pa., 1765; d. 1825; artist painter; invents steamboat 1793; invents submarine torpedoes 1797 to 1801; builds steamboat in France 1803; launches passenger boat Clermont at N. Y. 1807, and steams to Albany; 1812, builds steam ferryboats; 1814, builds first steam war vessel.

Jethro Wood, inventor of the modern cast-iron plow; b. White Creek, N. Y., 1774; d. 1834; patented the plow 1814: previously the plow was a stick of wood plated with iron; lawsuits against infringers consumed his means; Secretary Seward said: "No man has benefited the country pecuniarily more than Jethro Wood, and no man has been as inadequately rewarded."

Thomas Blanchard; b. 1788, Sutton, Mass.; d. 1864; invented tack machine 1806; builds successful steam carriage 1825; builds the stern-wheel boat for shallow waters, now in common use on Western rivers; 1843, patents the lathe for turning irregular forms, now in common use all over the world for turning lasts, spokes, axe-handles, gun-stocks, hat-blocks, tackle-blocks, etc.

Ross Winans, of Baltimore; b. 1798, N. J.; author of many inventions relating to railways; first patent, 1828; he designed and patented the pivoted, double truck, long passenger cars now in common use. His genius also assisted the development of railways in Russia.

Cyrus H. McCormick, inventor of harvesting machines; b. Walnut Grove, Va., 1809; in 1851 he exhibited his invention at the World's Fair, London, with practical success. The mowing of one acre was one man's day's work; a boy with a mowing machine now cuts 10 acres a day. Mr. McCormick's patents made him a millionaire.

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Charles Goodyear, inventor and patentee of the simple mixture of rubber and sulphur, the basis of the present great rubber industries throughout the world; b. New Haven, Conn., 1800; in 1839, by the accidental mixture of a bit of rubber and sulphur on a red-hot stove, he discovered the process of vulcanization. The Goodyear patents proved immensely profitable.

Samuel F. B. Morse, inventor and patentee of electric telegraph; b. Charlestown, Mass., 1791; d. 1872; artist painter; exhibited first drawings of telegraph 1832; half-mile wire in operation 1835; caveat 1837; Congress appropriated $30,000 and in 1844 first telegraph line from Washington to Baltimore was opened; after long contests the courts sustained his patents and he realized from them a large fortune.

Elias Howe, inventor of the modern sewing machine; b. Spencer, Mass., 1819; d. 1867; machinist; sewing machine patented 1846; from that time to 1854 his priority was contested and he suffered from poverty, when a decision of the courts in his favor brought him large royalties, and he realized several millions from his patent.

James B. Eads; b. 1820; author and constructor of the great steel bridge over the Mississippi at St. Louis, 1867, and the jetties below New Orleans, 1876. His remarkable energy was shown in 1861 when he built and delivered complete to the Government, all within sixty-five days, seven iron-plated steamers, 600 tons each; subsequently other steamers. Some of the most brilliant successes of the Union arms were due to his extraordinary rapidity in constructing these vessels.

Prof. Joseph Henry; b. Albany, N. Y., 1799; d. 1878; in 1828 invented the present form of the electro-magnet which laid the foundation for practically the entire electrical art and is probably the most important single contribution thereto. In 1831 he demonstrated the practicability of the electric current to effect mechanical movements and operate signals at a distant point, which was the beginning of the electro-magnetic telegraph; he devised a system of circuits and batteries, which contained the principle of the relay and local circuit, and also invented one of the earliest electro-magnetic engines. He made many scientific researches in electricity and general physics and left many valuable papers thereon. In 1826 he was a professor in the Albany Academy; was Professor of Natural Philosophy at the College of New Jersey in 1832, and in 1846 was chosen secretary of the Smithsonian Institution at Washington, where he remained until his death. Prof. Henry was probably the greatest of American physicists.

Dr. Alexander Graham Bell, the inventor of the telephone; b. 1847 at Edinburgh, Scotland, moved to Canada 1872 and afterward to Boston; here he became widely known as an instructor in phonetics and as an authority in teaching the deaf and dumb; in 1873 he began the study of the transmission of musical tones by telegraph; in 1876 he invented and patented the speaking telephone, which has become one of the marvels of the nineteenth century and one of the greatest commercial enterprises of the world; in 1880 the French Government awarded him the Volta prize of $10,000, and he has subsequently received the ribbon of the Legion of Honor from France and many honorary degrees, both at home and abroad; Dr. Bell still continues his scientific work at his home in Washington and has made valuable contributions to the phonograph and aerial navigation.

[Prof. Bell is now generally known as Dr. Bell, out of respect for his honorary degree.]

Thomas A. Edison; b. 1847, at Milan, Ohio; from a poor boy in a country village, with a limited education, he has become the most fertile inventor the world has ever known; his most important inventions are the phonograph in 1877, the incandescent electric lamp, 1878; the quadruplex telegraph, 1874–1878; the electric pen 1876; magnetic ore separator, 1880, and the three-wire electric circuit, 1883; his first patent was an electric vote-recording machine, taken in 1869, since which time more than 700 patents have been granted him; early in life Edison started to run a newspaper, but his genius lay in the field of electricity, where as an expert telegrapher he began his great reputation; his numerous inventions have brought him great wealth; a fine villa in Llewellyn Park, at Orange, N. J., is his home, and his extensive laboratory near by is still the scene of his constant work; he is the world's most persevering inventor.

Captain John Ericsson; b. 1803 in Sweden; d. in New York, 1889; at ten years of age, designed a sawmill and a pumping engine; made and patented many inventions in England in early life; in 1829 entered a locomotive in competition with Stephenson's Rocket; in 1836 patented in England his double-screw propeller and shortly after came to the United States and incorporated it in a steamer; in 1861, built for the United States Government the turret ironclad Monitor; was the inventor of the hot-air engine which bears his name; also a torpedo boat which was designed to discharge a torpedo by means of compressed air beneath the water; he was an indefatigable worker and made many other inventions; his diary, kept daily for 40 years, comprehended 14,000 pages.

Charles F. Brush; b. near Cleveland, Ohio, 1849; prominently identified with the development of the dynamo, the arc light and the storage battery, in which fields he made many important inventions; in 1880 the Brush Company put its electric lights into New York City and has since extended its installations into most of the cities and towns of the United States; in 1881, at the Paris Electrical Exposition, he received the ribbon of the Legion of Honor.

George Westinghouse, Jr.; b. at Central Bridge, N. Y., 1846; while still a boy he modeled and built a steam engine; his first profitable invention was a railroad frog; his most notable inventions, however, were in railroad airbrakes, the first patents for which were taken out in 1872; the system now known by his name has grown to almost universal adoption and constitutes a great labor-saving and life-saving adjunct to railroad transportation; Mr. Westinghouse, whose home is at Pittsburg, was one of the earliest to develop and use natural gas from deep wells; in late years he has made and patented many inventions in electrical machinery for the development of power and light, and has commercially developed the same on a large scale.

Ottmar Mergenthaler; b. 1854, at Würtemberg, Germany; d. 1899; inventor of the linotype machine; his early training as a watch and clock maker well fitted him for the painstaking and complicated work of his life, which was to make a machine which would mold the type and set it up in one operation; in 1872 Mergenthaler came to Baltimore and entered a machine shop, in which he subsequently became a partner; the first linotype machine was built in 1886 and put to use in the composing room of the New York Tribune; to-day all large newspaper and publishing houses are equipped with great batteries of these machines, costing over $3,000 each, and each performing the work of five compositors.

William Painter, b. 1838, d. 1906; was one of the most prolific inventors in the world. He was the recipient of nearly 100 United States patents, to say nothing of their foreign offspring. He was best known, however, as the inventor of the crown cork, the loop seal, and the aluminum system of bottle sealing and all the machinery employed in their manufacture, and was secretary and general manager of the Crown Cork & Sealing Company until 1903. This company has factories in all parts of the world.

Loring Coes, b. 1812, Worcester, Mass.; d. 1906; inventor of the hand screw wrench which bears his name. As many as 6,000 to 9,000 of these wrenches are manufactured monthly.

Daniel Baird Wesson, b. Worcester, Mass., 1825; d. 1906; began life on a farm; afterwards worked at shoe-pegging. He always wished to learn gun-making and learned the trade under his brother. A practical cartridge was the earliest fruit of his inventive mind. This did away with percussion caps. Then he secured a patent for a steel disk on which the hammer could explode the percussion material, doing away with the primer. It was in working out this plan that Mr. Wesson became associated with the late Horace Smith, and the world-recognized firm of Smith & Wesson was formed.

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# SOME STATISTICS ABOUT INVENTIONS.

The first recorded patent granted by the United States Government bears date July 31, 1790, issued to Samuel Hopkins, for making pot and pearl ashes. Two other patents were granted in that year. In the following year, 1791, thirty-three patents were granted. Among them were six patents to James Rumsay and one to John Fitch for inventions relating to steam engines and steam vessels. For the single year of 1876 the number of patents and caveats applied for was almost 20,000.

Since July 28, 1836, 667,173 patents for inventions, and since 1842 34,018 patents for designs have been issued by this office. Many of these patents are for minor improvements, but among them may be found a very large number covering the most remarkable and valuable inventions, which have added untold sums to the world's wealth, revolutionized the old arts, created new ones, brought old time luxuries within the reach of all, and made life doubly worth living. These contributions have come from men and women, white and colored. To many inventors more than a hundred patents have been issued. The following are some of the inventors who have received more than that number between 1872 and 1900, both years inclusive:

| | | | |
|---|---|---|---|
| Thomas A. Edison | 742 | Lewis H. Nash | 142 |
| Francis H. Richards | 619 | Edwin Norton | 141 |
| Elihu Thomson | 444 | Abbot Augustus Low | 137 |
| Charles E. Scribner | 374 | Philip Diehl | 137 |
| Luther C. Crowell | 293 | James C. Anderson | 135 |
| Edward Weston | 280 | Edward J. Brooks | 133 |
| Rudolph M. Hunter | 276 | Elmer A. Sperry | 132 |
| Charles J. Van Depoele (deceased) | 245 | Peter K. Dederick | 128 |
| George Westinghouse | 239 | Hosea W. Libbey | 12[illegible] |
| John W. Hyatt | 209 | James F. McElroy | 121 |
| Freeborn F. Raymond, 2d | 182 | William N. Whiteley | 121 |
| Sydney H. Short | 178 | Horace Wyman | 118 |
| Rudolph Eickemeyer (deceased) | 171 | Frank Rhind | 117 |
| Milo G. Kellogg | 159 | Louis K. Johnson | 114 |
| Walter Scott | 156 | Warren H. Taylor | 112 |
| Arthur J. Moxham | 150 | James M. Dodge | 111 |
| Cyrus W. Saladee | 148 | George H. Reynolds | 110 |
| Louis Goddu | 146 | Talbot C. Dexter | 109 |
| Hiram S. Maxim | 146 | James H. Northrop | 102 |
| George D. Burton | 144 | | |

From 1790 to March 1, 1895, some 5,535 patents were granted to women. It is a fair estimate that out of every 1,000 patents one is granted to a woman. As a rule women take out but one patent, although there are many exceptions. While the majority of patents granted them are for improvements in wearing apparel and in articles for household use, they have invented and received patents for adding machines, windmills, horseshoes, agricultural implements and fire escapes.

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To some 165 colored inventors about 400 patents have been issued. Twenty-eight patents have been issued to one and to another 22. So far as the records show, Henry Blair, of Maryland, was the first colored patentee. In 1834 he received a patent for a corn planter, and in 1836 one for a cotton planter. The character of their inventions follows lines suggested by their employment. Employed in the field and in the house, improvements in agricultural implements and articles of domestic use predominate. The sphere of their inventive effort has widened with the added opportunities afforded them to engage in mechanical vocations. They have made contributions to the electric arts and steam engineering, and many improvements in railway appliances and paper-bag machines. Before the Civil War the master of a slave living in Mississippi made application for a patent, but the Attorney-General held in an opinion reported in vol. 9, Attorney-General's Opinions, page 171, that an invention of a slave, though it be new and useful, could not be patented.

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# FIRST STEAMBOATS, PIONEER SAILING, AND EARLIEST LINES.

1707. Denis Papin experimented on River Fulda with paddle-wheel steamboat.

1736. Jonathan Hulls patented designs similar to modern paddle boat.

1769. James Watt invented a double acting side-lever engine.

1783. Marquis de Jouffroy made experiments in France.

1785. James Rumsey, in America, propelled a boat with steam through a stern-pipe.

1785. John Fitch, in America, propelled a boat with canoe-paddles fixed to a moving beam.

1787. Patrick Miller, of Edinburgh, tried primitive manual machinery.

1788. Miller, with Symington, produced a double-hull stern-wheel steamboat.

1802. *Charlotte Dundas*, the first practical steam tugboat, designed by Symington.

1807. *Clermont*, first passenger steamer continuously employed; built by Fulton in U. S. A.

1808. *Phœnix*, screw-boat, designed by Stevens in New York; first steamer to make a sea voyage.

1812. *Comet*, first passenger steamer continuously employed in Europe; built by Miller in Scotland.

1818. *Rob Roy*, first sea-trading steamer in the world, built at Glasgow.

1819. *Savannah*, first auxiliary steamer, paddle wheels, to cross the Atlantic; built in New York.

1821, *Aaron Manby*, first steamer (English canal boat) built of iron.

1823. City of Dublin Steam Packet Co. was established.

1824. General Steam Navigation Co. was established at London.

1824. George Thompson & Co. (Aberdeen Line), were established.

1825. *Enterprise* made the first steam passage to India.

1825. *William Fawcett*, pioneer steamer of the P. & O. S. N. Co.

1830. T. & J. Harrison (Harrison Line) were established at Liverpool.

1832. *Elburkah*, iron steamer, took a private exploring party up the Niger.

1834. Lloyd's Register for British and Foreign Shipping established.

1836. Austrian Lloyd Steam Navigation Co. established at Trieste.

1837. *Francis B. Ogden*, first successful screw tugboat; fitted with Ericsson's propeller.

1838. *Archimedes*, made the Dover-Calais passage under two hours, fitted with Smith's propeller.

1838. *R. F. Stockton*, built for a tugboat, fitted with Ericsson's propeller, sailed to America; first iron vessel to cross the Atlantic; first screw steamer used in America.

1839. *Thames*, pioneer steamer of the Royal Mail Steam Packet Co.

1839. George Smith & Sons (City Line) were established at Glasgow.

1840. *Britannia*, pioneer steamer of the Cunard Line.

1840. *Chile*, pioneer steamer of the Pacific Steam Navigation Co.

1845. *Great Britain*, first iron screw steamer, precursor of modern Atlantic steamer.

1845. Thos. Wilson, Sons & Co., Ltd. (Wilson Line), established at Hull.

1847. Pacific Mail Steamship Co. established in America.

1849. Houlder Brothers & Co. established at London.

1850, Bullard, King & Co. (Natal Line) established at London.

1850. Messageries Maritimes de France established.

1850. Inman (now American) Line, established at Liverpool.

1851. *Tiber*, first steamer of the Bibby Line, established 1821 at Liverpool.

1852. *Forerunner*, pioneer steamer of the African Steamship Co.

1853. Union Steamship Co. was established (now Union-Castle Line.)

1853. *Borussia*, first steamer of the Hamburg-American Packet Co. established 1847.

1854. *Canadian*, first steamer of the Allan Line, established 1820.

1855. British India Steam Navigation Co. was established.

1856. *Tempest*, first steamer Anchor Line.

1858. *Bremen*, first Atlantic steamer of the Norddeutscher Lloyd, established 1856.

1858. *Great Eastern* launched into the Thames. Jan. 31; commenced May 1, 1854.

1905. First Turbine Atlantic Liner *The Victorian*, crossed from Liverpool to Montreal.

# AGRICULTURAL MACHINERY.

BY

ARCHIBALD WILLIAMS.

WE should reasonably expect that the immense advance made in mechanical science during the last century should have left a deep mark on agricultural appliances. Such an expectation is more than justified; for are there not many among us who have seen the sickle and the flail at work where now the "self-binder" and threshing machine perform the same duties in a fraction of the time formerly required? The ploughman, plodding sturdily down the furrow behind his clever team, is indeed still a common sight; but in the tilling season do we not hear the snort of the steam-engine, as its steel rope tears a six-furrow plough through the mellow earth? When the harvest comes we realize even more clearly how largely machinery has supplanted man; while in the processes of separating the grain from its straw the human element plays an even smaller part. It would not be too much to say that, were we to revert next year to the practices of our grandfathers, we should starve in the year following.

The firm of Messrs. John Fowler & Company, of Leeds, England, is most intimately connected with the introduction of the steam plough and cultivator. Their first type of outfit included one engine only, the traversing of the plough across the field being effected by means of cables passing round a pulley on a low, four-wheeled truck, moved along the opposite edge of the field by ropes dragging on an anchor. Another method was to have the engine stationary at one corner of the field, and an anchor at each of the three other corners, the two at the ends of the furrow being moved for every journey of the plough. In, or about, the year 1865 this arrangement succumbed

From "The Romance of Modern Mechanism." London.

to the simple and, as it now seems to us, obvious improvement of introducing a second engine to progress vis-à-vis with the first, and do its share of the pulling. The modern eight-furrow steam plough will turn ten acres a day quite easily, at a much lower cost than that of horse labor. For tearing up land after a crop "cultivators" are sometimes used. They have arrowhead-shaped coulters, which cut very deep and bring large quantities of fresh earth to the surface.

The ground is now pulverized by harrows of various shapes, according to the nature of the crop to be sown. English farmers generally employ the spike harrow; but American agriculturists make great use of the spring-tooth form, which may best be described as an arrangement of very strong springs much resembling in outline the springs of house bells. The shorter arm is attached to the frame, while the longer and pointed arm tears the earth.

In highly civilized countries the man carrying a basket from which he flings seeds broadcast is a very rare sight indeed. The primitive method may have been effective — a good sower could cover an acre evenly with half a pint of turnip seed — but very slowly. We now use a long bin mounted on wheels, which revolves discs inside the bin, furnished with tiny spoons round the periphery to scoop small quantities of seed into tubes terminating in a coulter. The farmer is thus certain of having evenly planted and parallel rows of grain, which in the early spring, when the sprouting begins, make so pleasant an addition to the landscape.

The "corn," or maize, crop of the United States is so important that it demands special sowing machinery, which plants single grains at intervals of about eighteen inches. A somewhat similar device is used for planting potatoes.

Passing over the weeding machines, which offer no features of particular interest, we come to the reaping machines, on which a vast amount of ingenuity has been expended. At the beginning of the nineteenth century the

Royal Agricultural Society of Great Britain offered a prize for the introduction of a really useful machine which should replace the scythe and sickle. Several machines were brought out, but they did not prove practical enough to attract much attention. Cyrus H. McCormick invented the reaper in 1831, which, with very many improvements added, is to-day employed in all parts of the world. The most noticeable point of this machine was the bar furnished with a row of triangular blades which passed very rapidly to and fro through slots in an equal number of sharp steel points, against which they cut the grain. The to-and-fro action of the cutter-blade was produced by a connecting-rod working on a crank rotated by the wheels carrying the machine.

The first McCormick reaper did wonders on a Virginian farm; other inventors were stimulated; and in 1833, there appeared the Hussey reaper, built on somewhat similar lines. For twelve years or so these two machines competed against one another all over the United States; and then McCormick added a raker attachment, which, when sufficient grain had accumulated on the platform, enabled a second man on the machine to sweep it off to be tied up into a sheaf. At the Great Exhibition held in London in 1851, the judges awarded a special medal to the inventor, reporting that the whole expense of the Exhibition would have been well recouped if only the reaper were introduced into England. From France McCormick received the decoration of the Legion of Honor "for having done more for the cause of agriculture than any man then living."

It would be reasonable to expect that, after this public recognition, the mechanical reaper would have been immediately valued at its true worth. "Yet no man had more difficulty in introducing his machines than that pioneer inventor of agricultural implements. Farmers everywhere were slow to accept it, and manufacturers were unwilling to undertake its manufacture. Even after the value of the machine had been demonstrated, everyone seemed to fear that it would break down on rocky

and uneven fields; and the inventor had to demonstrate in person to the farmers the practicability of the reapers, and then even guarantee them before the money could be obtained. Through all these trying discouragements the persistent inventor passed before he saw any reward for the work that he had spent half a lifetime in perfecting. The ultimate triumph of the inventor may be sufficient reward for his labors and discouragements, but those who would begrudge him the wealth that he subsequently made from his invention should consider some of the difficulties and obstacles he had to overcome in the beginning."[1]

In 1858 an attachment was fitted to replace the second passenger on the machine. Four men followed behind to tie up the grain as it was shot off the machine.

Inventors tried to abolish the need for these extra hands by means of a self-binding device.

A practical method, employing wire, appeared in 1860; but so great was the trouble caused by stray pieces of the wire getting into threshing and other machinery through which the grain subsequently passed that farmers went back to hand work, until the Appleby patent of 1873 replaced wire by twine. Words alone would convey little idea of how the corn is collected and encircled with twine; how the knot is tied by an ingenious shuttle mechanism; and how it is thrown out into a set of arms which collect sufficient sheaves to form a "stook[2]" before it lets them fall. So we would advise our readers to take the next chance of examining a modern self-binder, and to persuade the man in charge to give as lucid an explanation as he can of the way in which things are done.

Popular prejudice having once been conquered, the success of the reapers was assured. The year 1870 saw 60,000 in use; by 1885 the output had increased to 250,000; and to-day the manufacture of agricultural labor-saving machines gives employment to over 200,000 people; an equal number being occupied in their transport and sale in all parts of the globe.

[1] *Cassier's Magazine.* [2] A "stook" in England is 12 sheaves.

In California, perhaps more than in any other country, "power" agricultural machinery is seen at its best. Great traction engines here take the place of human labor to an extraordinary extent. The largest, of 50 h. p. and upwards, "with driving-wheels 60 inches in diameter and flanges of generous width, travel over the uneven surface of the grain fields, crossing ditches and low places, and ascending the sides of steep hills, with as much apparent ease as a locomotive rolls along its steel rails. Such powerful traction-engines, or 'automobiles' as they are commonly called, are capable of dragging behind them sixteen 10-inch ploughs, four 6-foot harrows, and a drill and seeder. The land is thus ploughed, drilled, and seeded all at one time. From fifty to seventy-five acres of virgin soil can thus be ploughed and planted in a single day. When the harvest comes the engines are again brought into service, and the crops that would ordinarily defy the best efforts of an army of workmen are garnered quickly and easily. The giant harvester is hitched to the traction-engine in place of the ploughs and harrows, and cuts, binds, and stacks the golden wheat from seventy-five acres in a single day. The cutters are 26 feet wide, and they make a clear swathe across the field. Some of them thresh, clean, and sack the wheat as fast as it is cut and bound. Other traction engines follow to gather up the sacked wheat, and whole train-loads of it thus move across the fields to the granaries or railways of the seaboard or interior."

For "dead ripe" crops the "header" is often used in California. Instead of being pulled it is pushed by mules, and merely cuts off the heads, leaving the straw to be trampled down by the animals since it has no value. Swathes as wide as 50 feet are thus treated, the grain being threshed out while the machine moves.

One of the most beautiful, and at the same time useful, crops in the world is that of maize, which feeds not only vast numbers of human beings, but also countless flocks and herds, the latter eating the green stalks as well as the ripened grain. The United States alone produced no

less than 2,523,648,312 bushels of this cereal in 1902, as against 987,000,000 bushels of wheat, and 670,000,000 bushels of barley. Now, maize has a very tough stalk, often 10 feet high and an inch thick, which cannot be cut with the ease of wheat or barley. So a special machine has been devised to handle it. The row of corn is picked up, if fallen, by chains furnished with projecting spikes working at an angle to the perpendicular, so as to lift and simultaneously pull back the stalks, which pass into a horizontal V-shaped frame. This has a broad opening in front, but narrow towards its rear end, where stationary sickles fixed on either side give the stalk a drawing cut before it reaches the single knife moving to right and left in the angle of the V, which severs the stalk completely. The McCormick machine gathers the corn in vertical bundles, and ties them up ready for the "shockers."

In principal threshing machines are simple enough. The straw and grain is fed into a slot and pulled down between a toothed rotating drum and a fixed toothed concave. These tear out the grain from the ear. The former falls into the hopper of a winnowing and riddling machine, which clears it from dust and husks, and allows it to pass to a hopper. An endless chain of buckets carries it to the delivery bins, holding just one sackful each, which when full discharge the grain through spouts into the receptacle waiting below their mouths. An automatic counter records the number of sackfuls of corn that have been discharged, so that dishonesty on the part of employees becomes practically an impossibility. While the grain is thus treated, oscillating rakes have arranged the straw and shaken it out behind in a form convenient for binding, and the chaff has passed to its proper heap, to be used as fuel for the engine or as food for cattle.

On water, rail, and road the petrol engine has entered into rivalry with steam—very successfully too. And now it bids fair to challenge both steam engine and horse as the motive power for agricultural operations. The motor is not beautiful to look upon; its sides are slab, its outlines rather suggestive of an inverted punt. But it

DAISY
Deer

HARVESTING MACHINERY

1. Reaper at work in an oat field in Sweden.

2. Grain-binder at work in Portland, Oregon.

is a willing and powerful worker; requires no feeding in the early hours of the morning; no careful brush down after the day's work; no halts to ease wearied muscles. In one tank is petrol, in another lubricating oil, in a third water to keep the cylinders cool. A double-cylinder motor of 18 h.p. transmits its energy through a large clutch and train of cogs to the road wheels, made extra wide and well corrugated so that they shall not sink into soft ground or slip on hard. There is a broad pully-wheel peeping out from one side of the machine, which is ready to drive chaff-cutters or threshers, pump, grind corn, or turn a dynamo at a moment's notice.

Hitch the "Ivel" on to a couple of reapers or a three-furrow plough, and it soon shows its superiority to "man's friend." Here are some records:

Eleven acres, one rood, thirteen poles of wet loam land ploughed in 17½ hours, at a cost per acre of $1.25.

Nineteen acres of wheat reaped and bound in 10 hours, at a cost of 44 cents per acre.

Fifteen acres, three roods of heavy grass cut in 3½ hours, cost, 25 cents per acre.

With horses the average cost of plowing is about $2 an acre; of reaping $1.25. So that the motor does at least twice the work for the same money.

We may quote a paragraph from the pen of "Home Counties," a well-known and perspicacious writer on agricultural topics.

"It is because motor-farming is likely to result in a more thorough cultivation of the land and a more skillful and more enlightened practice of agriculture, and not in a further extension of those deplorable land-scratching and acre-grasping methods of which so many pitiful examples may be seen on our clay soils, that its beginnings are being sympathetically watched by many people who have the best interests of the rural districts and the prosperity of agriculture at heart."[1]

In France, Germany, Austria, and the United States

[1] *The World's Work*, vol. iii. 499.

the electric motor has been turned to agricultural uses. Where water-power is available it is peculiarly suitable for stationary work, such as threshing, chaff-cutting, root-slicing, grinding, etc. The current can be easily distributed all over a large farm and harnessed to portable motors. Even ploughing has been done with electricity: the energy being derived either from a steam engine placed near by, from an overhead supply passing to the plough through trolley arms simila to those used on electric cars.

The great advances made recently in electrical power transmission, and in the efficiency of the electric motor, bring the day in sight when on large properties the fields will be girt about by cables and poles as permanent fixtures. All the usual agricultural operations of ploughing, drilling, and reaping will then be independent of horses, or of steam engines panting laboriously on the headlands. In fact, the experiment has been tried with success in the United States. Whichever way we look, Giant Steam is bowing before a superior power

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## SOME WONDERS OF THE RAILROAD.

BY

ARCHIBALD WILLIAMS.

I. THE UNION PACIFIC RAILWAY THE FIRST OF THE TRANSCONTINENTALS.

ANY literary work that deals with the expansion of the United States can no more avoid references to the rise of the great railway tracks than the traveler can get from point to point without calling in the aid of the locomotive. In fact, so mightily has the invention of Trevethick grown and prospered under western skies, that the stories of the railroad and the

From 'The Romance of Modern Locomotion." London.

American people are intertwined in a manner that is without parallel in any other country of the world. And the same enterprising spirit that has raised the United States in a comparatively short time to a foremost place, both industrially and politically, among the nations, has also signalized them as in many ways the scene of the most marvelous advances in the science and practice of mechanical locomotion.

A glance at the railway map of the United States will be profitable and instructive to one whose knowledge of the geography of the country is deprived mainly from the dry details painfully accumulated in the school class-room. From St. Paul, on the Mississippi, the Great Northern reaches across to Seattle, on Puget Sound, Washington. One hundred and fifty miles south, on one average, runs the Northern Pacific, from the same eastern terminus, to Portland, Oregon — 2,056 miles; with other divisions and branches totalling over 5,000 miles. South of that again, the eye follows the route of the Chicago and Milwaukee from Lake Michigan to Omaha, whence the Union Pacific carries it on to Salt Lake City, where in turn the Southern Pacific rails takes up the running to San Francisco. At this great seaport terminates also the Southern Pacific track from New Orleans, passing through Louisiana, Texas, Arizona, and California, in a mighty sweep of 3,000 miles or more. In California it picks up the system known as the Atchison, Topeka & Santa Fé Railway, which in the heart of New Mexico throws off a branch that stretches hundreds of miles southwards towards the mouth of the Gulf of California. Besides these main lines there are others, too many to enumerate, though scarcely less important, which form links in the chief arteries of transcontinental traffic, some of them working in open rivalry to one another.

To-day the opening of such a line is a comparatively peaceful process; what fighting there may be is waged in Congress or the railway office. But when the surveyors and engineers of the Union Pacific first set their faces towards the prairies the railwayman carried his life in his

hand, and the pick and shovel had to do their work behind the protection of the rifle and revolver. The ancestors of the Indian who now, phlegmatic and half civilised, watches the express roar past, fought hard against the men who came out into the prairies with flags and chains and levels as the precursors of the greater army following behind to lay a path for the iron feet of the horse that would outstrip the mustang in speed, the buffalo in strength. Thirsting for blood, the Sioux hung round the camps, and awaited the opportunity to add one more item to the cruel record of the quarrel between red man and white. It may be truly said that these early transcontinental railways were in parts laid in blood, and marked by the lonely graves of the victims of arrow and tomahawk.

The first line built right across the States from the Missouri to the Pacific resulted from the private enterprise of a few small merchants of Sacramento, California. They, in 1861, organised the Central Pacific Railroad Company (now merged into the Southern Pacific) to carry the metals eastwards to the limits of California, where they should meet the platelayers working westwards from the Missouri, over the track now known as that of the Union Pacific Company. The project was formidable enough, including as it did the crossing of the Sierras at an elevation of 7,000 feet or more, and a plunge into the great territory, 1,400 miles long and 1,300 miles wide, which as late as 1850 was still marked as "unexplored desert"; a tract so unknown, that in one stretch of 665 miles there lived but one white man. The cross-country route used by the traders was not established till 1860, when a coaching and pony express came into being. The coaches — often laden with gold-seekers bound for the Californian fields — required, we read, "1,000 horses, 500 mules, and 700 men, of whom 150 were drivers. . . . . Travelers by this overland route had not only to face blizzards on the deserts, to cut their way through snowdrifts, to cross swollen streams, and to endure the other fatigues and privations

inevitable to a journey over deserts and mountains, but they had to run the risk of attacks from hostile Indians, and so frequent were these attacks that blood is said to have flowed in streams."[1]

The Sacramento merchants found support in the public opinion of the Eastern States, where bright dreams were being dreamed of the great possibilities for trade with China and Eastern Asia that would be opened by transcontinental rails. A strong feeling was also forming itself on a political basis, since the unsatisfactoriness of the isolation of the Pacific States became more and more apparent in the unsettled times preceding and continuing throughout the Civil War.

A bill was passed through Congress in July, 1862, assuring both the Central Pacific and Union Pacific of Government support, and a commencement was made in the same year at the Pacific end. Eastward, matters hung fire. Money was "tight," and the desert did not seem very attractive either to capital or labor. Consequently the charter, with its subsidy and land grants, fell somewhat flat, none of the railroads which, as President Lincoln imagined, would be benefited by the scheme coming forward to take a hand. They declared that they saw no prospects in a railroad across the desert. Individuals made desperate efforts to collect sufficient capital for a beginning, in the hope that when once things had been set in motion, money would come in. But to little purpose; and not till after the passing of a second bill in 1864, which doubled the land grant and offered a subsidy of $16,000 to $48,000 a mile of track, could a start be made at the Missouri end.

Among the engineers of the line was one Dodge,[2] who, as early as 1853, had been over the Iowa and Nebraska country, surveying and looking about for the best route for a railway. On more occasions than one he found himself in danger of annihilation by the Indians, who

[1] The *Times*, April 10, 1903.
[2] Afterwards General Dodge, and a prominent railway man.

then were mighty in the land. He pushed up the Platte River and across the plains as far as the Rockies, and took a liking for "South Pass" as the proper gate to a terminus on the Pacific, which he fixed at Portland, Oregon. In an interview with President Lincoln in 1863, he gave it as his opinion that the Union Pacific should at least start from Omaha, on the left bank of the Missouri opposite Council Bluffs.

Here, accordingly, in 1864 the first ground was broken for the Union Pacific Railway. At the commencement operations were much hampered by lack of transportation, as no railroad as yet reached the Missouri near Omaha, and all material had to be brought, at enormous cost, up the river from St. Louis. And even when considerable progress had been made, and people began to talk of the great future of the road, the granted lands did not sell well enough to cover current expenses, though the subsidy was paid as soon as a section had been completed. The Company was also seriously annoyed by the hostility of the Indians. These were ever with the surveyors going in advance of the construction trains. Many a promising young engineer found a grave in the prairie. Nor did the Sioux hesitate to attack the plate-laying gangs, stealing upon them under cover of a swell in the ground, and, before help could come, massacring them to a man. It was no rare thing for a party to return at nightfall to find a bunch of scalpless corpses where in the morning they had left a busy band of toiling comrades. So serious were the losses in the ranks, that it became necessary to import military guards to watch over the navvies as they struggled with ties and rails.

Yet the "rail-head" gradually crept westward across the prairie. In 1866, 260 miles of steel bars were spiked down to the sleepers; and by the end of the following year a locomotive could run 540 miles west of the Missouri. Nor were the Central Pacific folk idle. They had breasted the Sierras and prepared for the attack on the desert of Utah, where the Mormon stronghold of Salt Lake City alone had beaten back the desolation of that

rainless country. The Government subsidy, far heavier for mountainous than level stretches, now loomed large before the eyes of both parties. Each strove for the richer share of the spoil, the Central Pacific men on their slope, and the Union Pacific on the western flank of the Rockies. In the last lap across the plains the going was furious, and feeling ran so high that even when the graders working in advance of the platelayers met, they continued their onward course, until they overlapped nearly two hundred miles. It had already been settled by Congress, however, that where metals met metals, there a junction should be effected; and this happened at Promontory Point, near Ogden, in April, 1869. On May 10, in the presence of the rival armies of workers, and of a few outsiders who had come across the line for the purpose, four spikes, two of silver, two of gold, were driven home to complete the laying of the rails. A moment later the glad news had sped across the "whispering galleries" of the railroad, and in Chicago, New York, and Buffalo public thanksgivings proclaimed the opening of a new era in the history of the United States.

### II. THE BUILDING OF THE CANADIAN PACIFIC RAILWAY, THE GREAT CANADIAN HIGHWAY.

In Canada, as in the United States and Siberia, the origin of the first transcontinental line was political. As long ago as 1847 Major Carmichael Smyth urged upon the British Government the necessity of a great national highway from the Atlantic to the Pacific, to supply the last link in the chain round the world, uniting the English race by land and sea.

The Grand Trunk line had already opened communication by rail between Upper and Lower Canada and the United States. When, in 1871, British Columbia entered the Confederation of Canadian States, it was felt that mere political union would be but a weak bond, unless ready access to the Pacific seaboard were possible from

the older provinces. During the previous year the difficulty of quelling Louis Riel's rebellion on the Red River — only half-way across the continent — on account of the lack of means of transport, had brought home to the Government the fact that without a railroad the remote province on the Pacific would be very vulnerable in the event of war. It was also insisted, on the part of Columbia, that, as a condition of entering the Confederation, a railway should be thrown right across Canada.

The carrying out of so gigantic a task fell upon the Government, and the Premier, Sir John Macdonald, promised that the line should be completed in ten years. On July 20, 1871, the surveys were commenced in British Columbia, as they had already been on other portions of the route; and before the end of the year a practicable line had been discovered over the whole distance from Lake Superior to the Pacific. In order that the best possible path should be taken by the rails through the difficult country of the Rocky, Selkirk, Gold, and Cascade mountains on the west, and the Laurentian ranges round Lake Superior, the surveyors were hard at work for the next six years, on a task that cost the Canadian Government $3,750,000. Engineers explored the mountain passes in all directions, experiencing the hardships and dangers inseparable from travel in wild, icebound country, fissured by huge chasms, along the side of which they had to creep, and flanked by towering peaks that hurled down devastating avalanches. The adventures of these pioneers, thrilling and varied, are enough in themselves to fill a book, and, did space permit, might here be added as a most interesting chapter in the romance of the railway.

The task before the Government was as follows: to construct 2,500 miles of new line, 650 of which — between Ottawa river and Port Arthur, on Lake Superior — lay through a district notorious for its unsuitability for railway construction. From Lake Superior to Winnipeg, on the Red river, the country was also difficult, and west of Winnipeg the Prairie section stretched 900 miles to the Rocky mountains, a territory which, so far from being

of the billiard-table levelness of popular imagination, contains very little level ground. The west mountain section, through the Rockies to the Pacific, promised to strain the resources of the engineer to the utmost.

On February 17, 1881, the Canadian Pacific Railway Act received the Royal Assent, and the Company its charter. For the fulfilment of the contract, over 400 miles of rail must be laid each year; and in order to make this possible, work was commenced simultaneously at several points — on Lake Superior, at Ottawa, and at Winnipeg, westwards, and from the Pacific coast, eastwards.

The Company's chief energies were first concentrated on the section between Winnipeg and Calgary in the Rocky Mountains. It was decided to abandon the route mapped out originally by the Government surveyors north of Lake Manitoba and through Edmonton and Pine River Pass, and to follow a track some hundreds of miles further south through the Rockies; also to construct the line in a more substantial manner than the contract required.

The earthwork on the "prairie section" averaged some 17,000 cubic yards per mile, and, in order to avoid snow-block as far as possible, the railway ran along embankments.

Between May and December 1881, 165 miles were driven west from Winnipeg. The following year, to quicken operations, a contract was made by the Company with Messrs. Langdon & Shepherd, of St. Paul, Minnesota, to complete the line to Calgary. The contractors at once advertised for labor, offering $2.25 per diem to navvies, and $4.75 for two horses and a driver. They also sublet the work in sections, of a length varying with the ability and means of the contractor.

A vivid account given of the work on this section in the columns of Engineering will enable the reader to form some idea of the completeness of the organization required to lay 500 miles of rail in a single year.

"The rapidity of construction of this section of the

road is without a parallel in this or any other country. Where there was neither timber nor building stone all the materials had to be transported from 700 to 1,500 miles, and even the food and the commonest necessaries for the consumption of the men and the horses had to be brought on an average 1,000 miles, as the whole country west of Winnipeg was too new and unsettled to supply the simplest want. It was important that none of the sub-contractors should undertake more than they could accomplish within the specified time, and of the sixty parties employed, and over three hundred separate contracts let on the prairie section of the work, only twice was there any delay in this respect, or where the firm had to complete the work themselves. As soon as a gang had finished one section, they had to move from 100 to 150 miles ahead to their next location, where in another six weeks they were tolerably sure to hear the locomotives behind them, and the clanging of the hundred hammers of the platelayers close at their heels.

"In advance of the track-laying party were two bridge gangs, one working night and the other in the day, and as every stick of timber had to be brought from Rat Portage, 140 miles east of Winnipeg, they were seldom more than eight to ten miles ahead of the track-layers. The timber had to be hauled from the point where it could be unloaded, as near to the end of the track as possible, to the place where it was wanted, and this was generally done in the night to interfere as little as possible with the other work. Where not a stick of timber nor any preparation for work could be seen one day, the next would show two or three spans of a nicely-finished bridge, and twenty-four hours afterwards the rails would be laid and trains working regularly over it. Following these came the track-laying gang, the most attractive and lively party of the lot, and on which most of the interest of those who visited the work seemed to centre. There were three hundred men with thirty-five teams in this gang. Moving along slowly but with admirable precision, it was beautiful to watch them gradually coming near, every-

thing moving like clockwork, each man in his place, knowing exactly his work and doing it at the right time and in the right way. Onward they come, pass on, and leave the wandering spectator slowly behind whilst he is still engrossed with the wonderful sight. The returning locomotive, with her long string of empty cars rushing past him, awakens him from his reverie, and another, pushing before her more slowly her heavy load and taking them up to the front, shows him that where an hour before there was nothing but the upturned sod, two ditches, and a low embankment, there is now a finished working railway, and that the great Pacific highway is a fixed fact before his eyes. The emblem of civilization has passed, the subjugation of the land is accomplished, and that which was the hunting-ground of the Indian and the home of the buffalo yesterday, has gone forever from his occupation, is Britain to-day, not in name only but in use, and will probably be occupied within a week by some hopeful and happy British family, who in another season or two will make it a smiling home, and the abode of lasting comfort and prosperity. No wonder that it was a sight that hundreds came to see; it was a miracle of progress, the visible growth of an empire, the practical realisation of the dream of centuries, as the highway was gradually being laid down destined to conduct the commerce of Europe to that wonderful Orient where a prodigal Nature pours out her riches to supply the wants and luxuries of the world. All that Columbus and Champlain and others had hoped to discover, all that Magellan and Hudson and Franklin had died to find out, all that England and Spain had bestowed their money to explore, and all that France had lavished her energies and sacrificed her heroes to control, was quietly being accomplished by that motley gang and those few locomotives as the northwest passage to Asia was being gradually laid down over these hitherto unserviceable prairies. Each day from twenty to twenty-five 20-ton cars of rails and fastenings, and from forty to fifty cars of ties and other materials were laid down by this busy track-laying gang, and nearly all of

this had come an average of 1,000 miles by rail before it was safely delivered at the ' end of the track.' "

Under these conditions it is not surprising to learn that in 1882 no less than 349 miles of finished railway was laid, in addition to 110 miles of grading in advance. For some months operations were sadly delayed by the disastrous floods on the Red River; and in order to make up for lost time some extraordinary work was witnessed during the last six months of the year, during which railhead advanced at the rate of nearly two miles a day. Even this record was eclipsed in 1883, when for several weeks on end 3½ miles of track were completed daily, the finest record, that of July 28, being quite unsurpassed in railway construction.

On that day 6⅓ miles were laid. This is how the writer already quoted describes it:

" There were twenty-four men to handle the iron, that is, twelve unloading it from the cars, and twelve to load the trollies. It took the same number to lay it down in the track. The total number of rails laid that day was 2,120, or 604 tons. Five men on each side of the front car handed down 1,060 rails, 302 tons each gang, whilst the two distributors of angle-plates, and bolts, and adjustors of the rails for running out over the rollers, handled 2,120 rails, 4,240 plates, and 8,480 bolts. These were followed by fifteen bolters, who put in on an average 565 bolts each; then thirty-two spikers, with a nipper to each pair, drove 63,000 spikes, which were distributed by four peddlers. The lead and gauge spikers each drove 2,120 spikes, which, averaging four blows to each spike, would require 600 blows an hour for fourteen hours. There were 16,000 ties or sleepers unloaded from the trains, and reloaded on to wagons by thirty-two men, and thirty-three teams hauled them forward on to the track, averaging seventeen loads of thirty sleepers to each team. On the track eight men unloaded and distributed them, and four others spaced them, two others spaced and distanced the joint ties, and two others arranged and adjusted displaced ties immediately in front

of the leading spikers. Four iron carboys and two horses were used to haul the iron to the front. The first two miles of material were hauled ten miles along the prairie, and the rest from three miles up, as the usual side track gang put in a siding two thousand feet long during the day."

To feed the army of 9,000 men at work on the prairies over 150 miles of country was in itself a heavy task. The horses consumed 1,600 bushels of oats a day, and the men required the contents of two 35-foot trucks to keep them in condition for their severe labors. There was no underfeeding or bad provisions. In 1883 a thousand cattle died in the prairie slaughter-houses; three hundred sacks of flour were distributed among the army of navvies, who lived well on a generous variety of food. The camps were well policed. . . . All trains were carefully examined for contraband goods. If a man was detected importing liquor, he lost his property and fifty dollars. A second offense meant a $200 fine; on the third occasion it was doubled, and he was ornamented with a ball and chain on one leg. The fact that such magnificent work was done in Canada without the aid of alcohol is a serious blow to the claims put forward by a large portion of the community in this and other countries on behalf of the valuable properties of strong drink as a help for hard physical labor.

On August 15, 1883, the rail-head reached Calgary, and Messrs. Langdon & Shepherd's men were transferred to a fresh contract to penetrate the Rockies. In three seasons 962 miles had been laid between Winnipeg and these mountains. Meanwhile progress was being made in other sections. In British Columbia an army of 7,000 Chinese hacked and hewed its way through the Cascade Range, and as many more laborers were busy between Winnipeg and Ottawa, breaking down, with thousands of tons of dynamite, the tough Laurentian and Huron rocks. Along the northern shore of Lake Superior the amount of blasting to be done made it worth while to establish dynamite factories on the spot. A single mile of tunnelling by

the lake side is said to have cost $3,750,000. It was fortunate that, in spite of natural obstacles, the work was energetically carried out, winter and summer alike, since in the spring of 1885 Louis Riel, at the head of a band of malcontents, raised a second rebellion in the far Northwest, which was quickly crushed on account of the speed with which the nearly finished railway enabled the militia to arrive on the scene of action. Very shortly after this rebellion the line stretched continuously from Montreal to the summit of the Rockies.

The latter had been reached at the end of 1884, and the engineers paused awhile to consider the merits of the various routes open for the descending gradients on the Pacific slope. One of these, the Howse Pass, offered comparatively easy gradients, but it would have added thirty miles to the length of the line. The Kicking Horse Pass, on the other hand, was short but steep, and in order to complete the transcontinental track without loss of time, the engineers decided to build a temporary line through the Kicking Horse Pass, and replace it later on by the more circuitous but gentler gradients of the Howse Pass. "In the 44 miles between the summit of the Rockies and the mouth of the pass in the valley of the Columbia River, a fall of 2,747 feet was accomplished, and in that distance, in addition to other minor streams, the Kicking Horse River was crossed nine times, and, exclusive of tunnels, 1,500,000 cubic yards were excavated, 370,000 of which were of rock. The drilling for this, owing to the impossibility of conveying machinery to the spot, was done by hand. In one part treacherous landslips gave far more trouble than even the hardest rock."[1]

Early in 1885, while the eastern sections of the C.P.R. were being linked up round Lake Superior, a gap of only 220 miles remained in Columbia. But across the gap stretched the Selkirks and the Gold Range. The former had proved almost impenetrable even to the surveyors,

[1] *Quarterly Review*, 1888.

and when at last Major Rogers, the Company's engineer, acting on the advice of a Mr. Moberley — who in turn had got a hint from the flight of an eagle — discovered a practicable path, the platelayers were hard on his heels.

The two parties finally met in Eagle Pass, in the Gold Range. Before the last few miles had been laid the first transcontinental train was despatched from Montreal, on what was confidently expected to be an unbroken journey to the Pacific. On November 5, 1885, a day that should go down to posterity as marking a critical event in Canadian history, the last rail was laid, and the last spike driven, in a lonely forest glade at Craigellachie. There was no ceremony, no feasting or speechmaking to mark the event. The last spike was no golden one, such as closed the Northern Pacific plate-laying in the presence of a large multitude, but of plain iron like the millions of others that had preceded it. It was hammered in by Sir Donald Smith, a dozen or so persons looking on, and then the small party went off to fish, just as if the completion of so gigantic a work were quite an ordinary occurrence! But meanwhile the news was flashed over the wire spanning mountain and plain. The whole world knew that the line was open six months before time!

Thus in four years and a half 2,200 miles of rails had been laid, in a solid and substantial manner. At only one point between Montreal and Winnipeg does a gradient exceed fifty feet to the mile. Though there had been no obstruction from hostile Indians, such as had hindered the railway extension in the States, the route on the whole lay through difficult country. The Canadian Pacific Railway has a distinct advantage over the Northern Pacific and Union Pacific systems as regards the altitudes reached by its rails. The highest point above sea-level on the Canadian Pacific Railway is 5,296 feet, as against the 5,563 of the Northern Pacific and the 8,240 of the Union Pacific. As a transcontinental route it has also in its favor the fact that but 2,906 miles separate Montreal and Vancouver, as compared with the 3,271 miles between New York and San Francisco. Since the St. Law-

rence is open for traffic during the summer months only, the Government brought into being a line, known as "The International," to connect Montreal with the British ports of St John in New Brunswick and Halifax in Nova Scotia, which all the year round would give a clear run from the waters of one ocean to those of the other, the St. Lawrence being crossed by a magnificent bridge at Lachine.

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## SOME AMERICAN BRIDGES.

BY

ARCHIBALD WILLIAMS.

THE second place among monster bridges is held by the Brooklyn Suspension Bridge, connecting Manhattan Island, on which stands New York proper, with Long Island. Previously to 1883 New York, with its population of two millions, and Brooklyn, counting a million inhabitants, were kept in communication across a narrow strait, twelve miles long, opening into Long Island Sound, known as the East river, by a number of steam ferries, one of which alone transports 22,000,000 foot passengers and 1,100,000 vehicles annually.

With the growth of population the absence of some permanent connection between the two islands was so severely felt that it was determined to link the two with a bridge of such a height above the water as to offer no obstruction to the shipping passing down the Sound to New York harbor. The spot selected for the bridge is at the southern end of the East river strait, where it narrows down to a width of rather more than a quarter of a mile.

In deciding on the suspension type, American engineers had two good precedents — The Ohio river and Clifton Suspension at Niagara, which then held the record in

From "The Romance of Modern Engineering." London.

BROOKLYN BRIDGE

FROM A PHOTOGRAPH

Brooklyn Bridge was opened for traffic in May, 1883, having taken thirteen years to build and having cost about fifteen million dollars. It is 85 feet wide and spans about 1,600 feet of river, while on either side it runs over about 950 feet of land. The clear height of the bridge in the center of the river span is 135 feet above the water; the permanent weight suspended from the cables which hold up the bridge is 14,680 tons.

point of span. The Ohio bridge at Cincinnati had a clear leap of 1,000 feet; while that at Niagara measured 1,268 feet between the centres of the towers, standing on either side of the gorge below the Falls. This bridge, opened to traffic in 1869, as a result of but twelve months' work, hung from two cables 1,888 feet long, passing over rollers on the summit of the towers, which were built of wood strengthened by massive iron frames. The cables each contained 931 wires, 1-7-inch diameter, twisted into seven ropes. When loaded with an average amount of traffic the bridge weighed 360 tons. To prevent excessive lateral oscillation strong steel guy ropes were strung from various points on the structure to anchorages on the side of the gorge. After standing and doing useful service for many years, the bridge was destroyed by one of the tremendous hurricanes that periodically sweep down the Niagara gorge as through a funnel.

There remained, however, the Niagara Railway Suspension Bridge, completed in 1855. This has a span of 821 feet, the track passing 245 feet above the river. It should be explained that the lower chord of the bridge is a girder with two floors, the upper of which carries the railroad, while the lower serves for foot and ordinary vehicular traffic. As originally constructed two masonry towers bore the weight of the four cables — each containing 3,640 iron wires — that support the girder. After twenty-six years of wear it was discovered that these towers had been bent inwards to a dangerous extent, owing to the rollers on which the cable saddles work at the tower tops having become clogged with cement. The engineers therefore built iron skeleton towers outside the masonry, and without in any way interrupting the traffic of the bridge, transferred the cables from the stone to the iron supports by means of powerful hydraulic jacks. This is a most interesting feat, and probably unique. When the bridge was in course of construction Robert Stephenson, engaged on the Victoria Tubular Bridge at Montreal, said to the designer of the Niagara Suspension — Mr. John A. Roebling — "If your bridge succeeds,

mine is a magnificent blunder." The light American structure did succeed.[1]

The Brooklyn bridge, like that at Niagara, is carried on four main cables. The supports are two huge towers, rising 272 feet above high water. At the river level they measure 140 feet broad by 50 deep, which dimensions decrease to 120x40 feet at the summit.

On the New York side the masonry is carried down to rock 78 feet below water level, giving the tower a total height of 350 feet. The masonry built into the two towers aggregated 85,000 cubic yards. The central span is 1,595½ feet. Between the towers and the anchorages are two 930-foot spans; and beyond these approaches that add 2,534 feet to the total length — 5,989 feet, or about a mile and a furlong.

The most interesting feature of the bridge is the cable work. Each of the four cables, anchored at either end to massive 23-ton plates, embedded in huge masses of masonry, each representing more than 44,000 tons, contains 5,296 galvanized steel wires, which were carried separately from tower to tower, and bound up together in a parallel formation into a cylinder 15¾ inches in diameter.

The breaking strain of a cable is 12,000 tons. As each strand is 3,572 feet long, about 1,200 miles of wire were used in the cables.

These support six parallel steel trusses, on which is laid the roadway, 85 feet wide, divided into two carriage-tracks, two tramways, and one footway. The bridge rises towards its centre on a gradient of 3¼ per cent., the headway increasing from 119 feet at the towers to 135 in mid-channel.

The bridge cost $15,000,000, two-thirds of which was contributed by the Brooklyn municipality, and one-third by that of New York. It was begun in 1870 and opened to the public in 1883. Upwards of a quarter of a million people cross the bridge daily; but so great is the traffic

[1] "The Railways of America," by Thomas M. Cooley.

between Manhattan and Long Island that three more bridges across the East river, in the first rank of such structures, and formidable competitors in regard to size with the Brooklyn bridge, have become necessary.[1]

A traveler in the United States is struck by the versatility of the American bridge-builder, whose genius develops most happily towards the erection of light, airy viaducts spanning many of the valleys through which the great network of railways run. On the average there is one span of metallic bridge for every three miles of railway, giving a total of over 63,000. The increase in weight of locomotives and rolling-stock has led to the renewal of many of these bridges, by the substitution of more substantial work. And the rapid extension of existing systems constantly demands the manufacture of new bridges. Consequently the demand has driven manufacturers to standardise their patterns, and arrive at a distinct understanding with the railway engineers that, except in special cases, where divergence is unavoidable, all bridges ordered shall conform to certain stereotyped designs, which have been decided upon after much experimentation.

The American bridge-building companies, thanks to this scientific arrangement, and the large number of orders that they are called upon to fill, have advanced the practice of bridge-making to a point that enables them to compete favorably with the manufacturers of other countries. The American railway engineer gives measurements to the bridge company, which by long practice knows just what is required to meet a particular case, and turns it mechanics, armed with all manner of labor-saving tools, on to cheaply made steel. In a few weeks or months the bridge is ready for delivery, the makers confident that when the pieces are assembled *in*

[1]More wonderful still than the bridges connecting Manhattan island with the mainland and the adjacent islands, are the submarine tunnels now in course of construction. They are the latest triumphs of American inventiveness and engineering skill.

*situ* they will come together "like a clock." Very probably the company does the erecting as well, so that after the order is given the railway board's part of the work is confined to handing over a cheque to the proper amount, when the bridge has been passed by their engineers.

On American railroads the trestle bridge is a very common object, often towering to a giddy height, that dwarfs the giant locomotives passing overhead. In 1890 there were in the States 147,187 wooden trestle spans, aggregating 2,127 miles of track. These, as liable to insidious decay and danger from fire, are being replaced by steel structures as fast as is possible. A notable instance is the Portage viaduct on the Erie railway, New York, crossing a river 234 feet above the bed. The old viaduct contained more than a million and a half feet of timber, arranged in piers formed of three grouped trestles. This was burned in 1875, and in its stead now stands a remarkably slender-looking viaduct of wrought iron, weighing but a small fracture of the wooden structure.

The same railway boasts another remarkable viaduct, the Kinzua, 2,400 feet long and 305 feet high. It was built by Messrs. Clarke, Reeves & Co., in the short space of *three months,* without the use of any staging or ladders. The original spider-like supports have recently been replaced by steel trestles of a more solid nature, better calculated to sustain the great increase of rolling-stock weight.

Outside the country of its birth the American bridge is making headway. In recent years British builders have several times felt their inability to compete with their transatlantic cousins, when creation and erection has to be hurried through. To take three notable examples. The Atbara bridge, seven spans of 147 feet, was tendered for by American makers at about $55 per ton; construction to take six weeks and erection eight weeks. The nearest English tender showed about $78 per ton, and twenty-six weeks. The Uganda viaducts, East Africa, also fell to American makers, since their price was

but three-fifths of the English figures. And in the third instance, that of the Gokteik viaduct, Burma, their price was little more than half that of British makers, and the contract time one year as against three years. These examples show how unequal is the competition, owing largely to the conservatism of English methods, and the vexatious restrictions which hamper industrial progress. To "keep his end up" the British manufacturer will need to consign much of his machinery to the scrap heap, adopt standard designs, and instill a spirit of greater enterprise into his employés.

The Gokteik viaduct, as the loftiest trestle erection in the world, and among the latest born, deserves special notice. It affords a typical illustration of American methods.

The Burma railway, running from Rangoon to Mandalay, a distance of about 400 miles, has lately been extended in an easterly direction through the Shan States to Lashio, *en route* to the Kunlon Ferry on the Salween river, following the track over which in Marco Polo's time the Chinese armies marched to Mandalay.

Eighty miles east of the latter town is the Gokteik gorge, with an average depth of 1,300 feet, eaten out by the Chungzoune river. It was first proposed to cross this formidable obstacle by means of short rack railways on the Abt principle, which should lower trains from the high ground to a point in the gorge where huge blocks of limestone have fallen into the glen to form a natural bridge 500 feet above the river. A viaduct 80 feet high and 500 feet long would suffice for the crossing.

Eventually it was decided to flatten the grades of the approaches to 1 in 40, and raise the viaduct level to over 300 feet above the natural bridge. It should be said of the approaches themselves that they pass through very rough country, where the gradients are too steep to admit of curves. By means of switchback reversing stations every two or three miles the train clambers slowly upwards in a zigzag course, on the edge of awful precipices. On the eastern side of the gorge the line still

sticks to steep hillsides, passes through two tunnels and heavy cuttings, and then twists upwards by help of three semi-circular loops.

The viaduct was designed by Sir Alexander Rendel & Co., consulting engineers to the Burma Railways Company. The contract fell to the Pennsylvania Steel Company, of Steelton. Sir Frederic Fryer, Lieutenant-Governor of Burma, at the opening ceremonies, said that they obtained the contract because they were able to submit a far more favorable tender than any English firm, both in point of cost and of time.

Within four months of the signing of the contract the first shipload of material was despatched from New York. Two months later it arrived at Rangoon. The transport of 4,332 tons of steel over a line that had suffered severely from the 15-foot rainfall of the wet season was much delayed; but in spite of obstacles erection commenced in October.

To facilitate the classification and separation of the various parts and the handling of them by ignorant natives, each truss, girder, and column was painted a distinctive color, and the joints when shop-assembled were streaked with special combinations of stripes on each adjacent piece. Along with the bridge material came pneumatic reamers and riveting hammers, hoisting engines, derricks, telephones, and last, but by no means least, thirty-five American workmen.

To aid in the erection a temporary line was laid in zigzags down the side of the gorge; this carried material to the foot of the viaduct, and also helped the transport of rails, sleepers, and even two locomotives (in pieces) to the further side, where thirty-five miles of track were laid during the construction of the viaduct.

From Steelton to Gokteik is 10,599 miles, an almost, if not quite, unprecedented distance to send the ready-made up parts of so large a structure. As fast as the metal arrived at the bridge-end it was whipped out of the meter-gauge cars by great steam derricks, which handed them over to smaller derricks for sorting and

storage. At times the press of work was so heavy that the trucks, immediately they were emptied, were picked up by the 15-ton crane and set down on the bank in piles, many feet below the track, to make way for loaded cars.

As soon as sufficient stuff had accumulated the "traveler" was erected at the south end of the bridge. This machine, which plays so important a part in American bridge building, and is largely responsible for the celerity of operations, is a large framework, the rear end of which is anchored to a completed section of the structure, while the forward and larger part overhangs and acts as a crane through which parts of the next section are lowered into place. The Gokteik traveler was 24½ feet wide, 60 feet high, and 219 feet long, with an unprecedented overhang of 165 feet. Cars running along the track transferred joists and trusses to the running tackle, which quickly let them down and held them in position while the riveters, mostly natives, fixed them. Some British and German sailors proved very useful on the traveler and topmost points of the rising towers, and set a very wholesome example to the 350 odd coolies engaged.

Now for a few figures about the bridge. Its total length from abutment to abutment is 2,260 feet. For 281 feet at one end and 341 at the other, it is curved to a radius of 800 feet. The intermediate 1,638 feet runs tangentially (in a straight line) at a height varying between 130 and 320 feet above the natural bridge and valley slopes. There are seventeen spans, ten 120 feet long, seven 60 feet long. The fifteen trestles, or towers, each of four columns (with one exception), are 24½ feet broad at top, and widen towards the bottom with a batter of 5 in 24. The trestle is 40 feet long, and is divided into stories 35 feet high, which are braced diagonally. At the highest point of the viaduct, over the natural bridge, there is a double tower 80 feet long, with six columns 320 feet high. The 120-foot girders are of the lattice type, and 60 and 40-foot plate-sided, 42½ and 60¼ inches deep respectively.

Under favorable conditions the structure rose with astonishing speed, some of the 200-foot towers going up in three or four days. The double tower consumed a month, as its immense height rendered construction more dangerous, and consequently less easy.

As soon as a tower was finished, the big girders for the space intervening between it and that on which the traveler rested were swung out and fixed. Then followed horizontal stringers, cross floor beams, ties, and rails. These placed, the huge 100-ton framework rolled forward to the end of the new span, and commanded another masonry pier, whence a new tower began to rise.

On November 1, 1900, after nine months' labor, the last of the 200,000 field rivets was driven, and the Gokteik viaduct stood complete. As 800,000 rivets had already been closed in the shops, the total shows just one million. It is a striking testimony to the thoroughness of American workmanship that 232,868 separate pieces shipped from Steelton fitted with wonderful accuracy when assembled in the gorge. The bridge cost the Railway Company $300,625.

In August, 1906, an aerial tramway was completed by the Conrad Consolidated Mining Company, extending from Conrad City, B. C., four miles into the mountains, and containing the longest span of any aerial tramway in the world. It is 2,968 feet long. The next longest is 2,750 feet. So successful has it proved that the company is preparing to bring other similar tramways to mines.

No reference to American bridge building should go forth without containing the name of James Buchanan Eads, who is entitled to lasting fame for building the great steel arch bridge over the Mississippi river at St. Louis, one of the most wonderful bridges in the world.

He is not less famous for his improvements in the South Pass of that river, and his work of deepening its channel as far as the Ohio river by means of jetties.

Eads was born in Lawrenceberg, Ind., in 1820; was trained as a civil engineer; made a fortune in the business of raising sunken vessels, and, during the Civil War, constructed many ironclad gunboats for the Government.—[C. W.]

# THE BEGINNING OF BALLOONS.

BY

JOHN ALEXANDER.

JOSEPH and Etienne (Stephen) Montgolfier were managers of a paper-works at Annonay, in France, and it was Etienne who first demonstrated the practicability of the theories put forward by two scientists of his time, Cavallo and Dr. Black, that solid bodies could be raised in the atmosphere by being attached to vessels filled with gas of a lighter specific gravity than the surrounding air. Cavallo in 1772 had filled and floated soap bubbles with hydrogen in proof of this theory.

In 1783 Etienne succeeded, after many failures, in raising to a height of 1,500 feet a large balloon of linen and paper, thirty-five feet in diameter. In shape this balloon was much the same as thousands that have since been made: an ordinary sphere, and the gas was generated by burning moist straw, wool, and rags placed on an iron brazier beneath an opening at the bottom of the great bag.

For all practical purposes this was the first balloon. The invention created great excitement in France, which has remained to this day the home of ballooning. Paris immediately started a subscription to construct a great fire-balloon or "montgolfière," as they were called for many a day. The Montgolfiers were the heroes of the hour, patronised even by the king. Curiously enough, Etienne had not sufficient courage to trust himself to be borne aloft by the balloon he had invented.

The first aerial travelers by balloon were a sheep, a cock, and a duck, sent up in a cage attached to a montgolfière, which the inventor raised at Versailles in September of 1783 before the king and court.

The previous month M. Charles, Professor of Natural Philosophy in Paris, had gone one better than Mont-

From "The Conquest of the Air." London.

golfier, and sent aloft from the Champs de Mars a fine balloon filled with hydrogen, which gas had been first discovered by Cavendish in 1775. This balloon was thirteen feet in diameter. To the present day hydrogen remains the best material for inflating, being used by Señor Santos-Dumont, though it is much too expensive for all but the millionaire balloonist. Professor Charles' balloon fell at Gonesse, fifteen miles from Paris, about an hour after it had been sent up, and the amazement with which the peasantry witnessed its descent has been described in these words:

"It is supposed by many to have come from another world; others, more sensible, think it is a monstrous bird. After it has alighted there is some motion in it from the gas it still contains. A small crowd gains courage from numbers, and for an hour approaches by gradual steps, hoping, meanwhile, the monster will take flight. At length, one bolder than the rest takes his gun, stalks carefully to within shot, fires, witnesses the monster shrink, gives a shout of triumph, and the crowd rushes in with flails and pitchforks. One tears what he thinks to be the skin and causes a poisonous stench; again all retire. Shame, no doubt, now urges them on, and they tie the cause of alarm to the tail of a horse, who gallops across the country, tearing it to shreds."

The government even found it necessary to send a proclamation throughout the country explaining what a balloon was, and counseling the country-folk not to be alarmed if they happened to see one. In our own day the Russian Government had to do a very similar thing in connection with Andrè's attempt to reach the North Pole in a balloon. Some parts of the world move with the ages, others remain stock still.

The distinction of being the first of men to ascend into the air by means of a balloon belongs neither to the Montgolfiers nor to Professor Charles. Strangely enough, this honor rests with two men who ascended together, and one of whom — the Marquis d'Arlandes — was subsequently "broke for cowardice" in the discharge of his

military duties at the beginning of the French Revolution. Pilâtre de Rosier was the name of his companion in the first balloon ascent, which took place from the palace of La Muette, in the Bois de Boulogne, Paris, on November 21st, 1783.

From this time forward, according to an old writer, until the fatal termination of his career, M. Pilâtre de Rosier seems to have devoted himself entirely to the practice and improvement of the art of äerostation; a pursuit in which, however, he was not long destined to continue. On June 15, 1785, in company with a young gentleman, named Romain, he ascended at Boulogne-sur-Mer with the intention of crossing the channel into England by means of his balloon. Unfortunately the arrangements which he adopted to secure his success were the cause of his failure as well as of his destruction. In order to counteract the fluctuations consequent upon all äerial excursions under the ordinary circumstances, and to obtain the power of increasing or diminishing the weight of his apparatus at will, without the usual expenditure of gas and ballast, he had conceived the idea of uniting in one the two systems of Montgolfier and Charles, and, accordingly, attached to the hydrogen balloon, by which the principal part of the weight was to be borne, a small montgolfière or fire-balloon, by acting upon which he expected to be able to alter his specific gravity as occasion might require. As our authority points out, the theory was correct: the error lay in the application. Distended in the course of its elevation, the inflammable contents of the larger sphere soon filled the vacant portions of the silk, and pouring down the tube, which formed the neck of the balloon, speedily reached the furnace, which was disposed at its lower extremity, and became ignited. The whole apparatus was consumed in the air, and the two unfortunate voyagers precipitated upon the rocks which bound the shores of the sea between Calais and Boulogne.

Concurrently with these French experiments two American scientists, Rittenhouse and Hopkins, of Philadelphia, were also experimenting; and there is every rea-

son for believing that their application of hydrogen to the inflation of a balloon was made independently of Professor Charles's experiment. Instead of one large balloon, however, their äerostat consisted of forty-seven small balloons, to which a cage was attached. The scientists, careful of their own necks, induced a working carpenter, named James Wilcox, for a monetary consideration, to ascend in this cage at Philadelphia on December 28, 1783, and thus the first American to soar aloft into the air of liberty did so as a mercenary. In descending he narrowly escaped the broken neck which his employers had dreaded.

The next ascent was undertaken by Professor Charles from the Champs de Mars on December 18, 1783, in a balloon of twenty-seven feet in diameter, inflated with hydrogen. Charles was accompanied by a M. Robert, one of the makers of the balloon, and after returning to the ground, excited probably by his success and ignorant of the laws of ballast, he reascended alone, and went up with terrific velocity, owing to the sudden abstraction of so much weight. It is supposed that he reached an elevation of about 10,500 feet. After having experienced, according to his own description, much inconvenience from the altitude he had attained, he effected his descent without further danger or damage.

It is recorded by a contemporary pamphlet that MM. Charles and Robert were arrested, on returning to Paris, by order of the king, who, at the suggestion of two of his ecclesiastics, adopted this course to prevent the further endangering the lives of his subjects; but they were speedily discharged.

Joseph Montgolfier would now appear to have summoned up courage to risk a rise — or a fall — in a fire-balloon at Lyons, on January 19, 1784. The experiment was one of the most important of all the early ascents, being on a scale which was not exceeded for many years after. It will, therefore, be well to give a very full account of it, drawn from one of the earliest writers on äeronautics. The balloon employed was a pyriform ves-

sel, constructed of two layers of linen cloth, enclosing one of paper between them (for the purpose of increasing its imperviousness), and measured, when fully inflated, 130 feet in height and 105 feet in breadth. It was capable of containing 40,000 cubic feet of air, and, when charged for the ascent, supported with ease seven persons and ballast to the amount of 2,900 lbs. independent of its various accessories; its car, in the form of a gallery, seventy-two feet in circumference, accommodated with seats, four feet wide and eight apart; its furnace, twenty feet in diameter, with its fuel made up into faggots of wood and straw; its massive framework to maintain the lower aperture; its drapery, netting, cordage, implements, and other requisites all in the same proportion, the approximate weight of which it would be impossible now to determine.

The names of those who participated in the honor of this expedition were, Joseph Montgolfer himself, under whose direction the whole had been got up, Pilâtre de Rosier, le Comte de Laurencin, le Marquis de Dampierre, le Comte d'Anglefort, le Prince Charles de Lignes, and a young man named Fontaine, who, happening to be in the car at the moment when, suddenly lightened by the hasty departure of another gentleman, it escaped into the air, became accidently included in the party. In a few seconds it rose to an elevation of about 3,000 feet; an opening, however, of about four feet in length, which appeared about the equator of the balloon, soon brought it down again, with a velocity even greater than its ascent, and it reached the ground at a distance of about 12,000 feet from the place of its departure.

There is no record of Joseph Montgolfier ever having repeated the performance, and the next ascent worthy of notice was the first that took place from British soil. This experiment has the triple distinction of being the first by a native of Great Britain, and the only one for half a century ever carried out on the principle of the Montgolfiers' fire-balloon. The name of the daring Britisher was James Tytler, and Comely Gardens, Edin-

burgh, was the scene of his ascent. It took place on August 27, 1784 and is thus described by an eye-witness in the *London Chronicle:*

"Early this morning this bold adventurer took his first äerial flight. The balloon being filled at Comely Gardens, he seated himself in the basket, and the ropes being cut, he ascended very high, and descended quite gradually on the road to Restalrig, about half a mile from the place where he rose, to the great satisfaction of those spectators who were present. Mr. Tytler went up without the furnace this morning; when that is added he will be able to feed the balloon with inflammable[1] air, and continue his äerial excursions as long as he chooses. Mr. Tytler is now in high spirits, and in his turn laughs at those infidels who ridiculed his scheme as visionary and impracticable. Mr. Tytler is the first person in Great Britain who has navigated the air."

It is well that this exploit of Tytler's should be remembered, as it is a common error to credit a Signor Lunardi, a gentleman attached to the Neapolitan Embassy in London, with having made the first ascent in England, though in reality his ascent was made from the Royal Artillery Grounds, Moorfields, on September 15, 1784, almost a month after Tytler's performance. Lunardi made many other ascents in England and Scotland before returning to his native country to gratify the curiosity of the Italians, and, finally, to die in great poverty. The first balloon ever sent up in England was launched in London on November 25, 1783, by Count Zambeccari; but that celebrated äeronaut did not ascend himself until March 23, 1785, when, in company with Sir Edward Vernon, he made an äerial journey of twenty-five miles, landing at Horsham in less than an hour from leaving London. Zambeccari was one of the earliest victims of the dangerous montgolfières, having to make a fatal plunge from a burning balloon at Bologna on September

[1]A misnomer due to the correspondent's ignorance of the principle of inflation.

21, 1812. His companion on that occasion escaped, but with fearful injuries.

Such, then, was the beginning of ballooning. It will be gathered that the montgolfière was a very crude contrivance, and that a great step had been made the moment Professor Charles had proved the practicability of hydrogen as a material for inflation. The wonder is that the fire-balloon remained in use as long as it did. Damp straw, rotten meat, old boots — these were the fuel with which the heated air was generated, and the stench from the fire, apart altogether from the danger of the thing, was most offensive. No wonder that Louis XVI wished to prevent respectable citizens from risking their lives in such contrivances, and desired that the first men to ascend in one of these fire-balloons should be two criminals condemned to death.

With the use of hydrogen the balloon became, almost at one step, the machine which is familiar to all to-day, and has remained practically unchanged in any essential detail for upward of a hundred years. The principle of its construction is simplicity itself. A large pear-shaped bag of silk or linen, or both, well varnished — to make it as nearly air-tight as possible — with an open neck hanging downwards, and at the top a valve which can be opened when the aeronaut wishes to descend by letting out a quantity of gas. Over the balloon is a network of rope meshes from which the car, or basket, is suspended.

Ballast, in the shape of bags of sand to be thrown out as required, is the only method of changing the rate of upward progression, and vertical motion is the only direction in which the äeronaut has any control over the balloon. He cannot move it to the right or left; there it is at the mercy of the air-currents. A handful of ballast thrown out may send it up twenty yards, a whole bag thrown out would mean an upward rush at a tremendous speed. Even a chicken bone thrown out of the car has caused a rise of thirty yards!

In the higher latitudes where the atmosphere becomes lighter the gas in the balloon expands, and for this reason

the neck is left open, or fitted with a self-acting valve which enables the expanding gas to escape into the air. If the bag were closed it would burst when it reached the region of lighter air.

It was to an Englishman, Charles Green, the most famous British äeronaut, who flourished in the first part of last century, that we owe the invention of the guide-rope, and also the use of ordinary coal-gas for inflation. Hydrogen is much more buoyant, but many times more expensive and infinitely more difficult to apply. The guide-rope is used when traveling at any altitude up to 1,000 feet or thereabout above the ground. It hangs down from the car and, touching the ground, acts as a kind of support, enabling the balloon to travel at a fixed height over great distances. The moment the rope trails on the ground the part touching the earth is like ballast thrown out, and releases the balloon to that extent, while the part still hanging acts as ballast retained and equalizes this effect. It is also of immense use in breaking the rate of descent, and has often been the means of saving life.

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## CALCULATING MACHINES.

BY

ARCHIBALD WILLIAMS.

THE simplest form of calculating machine was the abacus, on which the schoolboys of ancient Greece did their sums. It consisted of a smooth board with a narrow rim, on which were arranged rows of pebbles, bits of bone or ivory, or silver coins. By replacing these little counters by sand, strewn evenly all over its surface, the abacus was transformed into a slate

From "The Romance of Modern Mechanism." London.

for writing or geometrical lessons. The Romans took the abacus, along with many other spoils of conquest, from the Greeks and improved it, dividing it by means of cross-lines, and assigning a multiple value to each line with regard to its neighbors. From their method of using the calculi, or pebbles, we derive our English verb, to *calculate*.

During the Middle Ages the abacus still flourished, and it has left a further mark on our language by giving its name to the Court of Exchequer, in which was a table divided into chequered squares like this simple school appliance.

Step by step further improvements were made, most important among them being those of Napier of Merchiston, whose logarithms vex the heads of our youth, and save many an hour's calculation to people who understand how to handle them. Sir Samuel Morland, Gunter, and Lamb invented other contrivances suitable for trigonometrical problems. Gersten and Pascal harnessed trains of wheels to their "ready-reckoners," somewhat similar to the well-known cyclometer.

All these devices faded into insignificance when Mr. Charles Babbage came on the scene with his famous calculator, which is probably the most ingenious piece of mechanism ever devised by the human brain. To describe the "Difference Engine," as it is called, would be impossible, so complicated is its character. Dr. Lardner, who had a wonderful command of language, and could explain details in a manner so lucid that his words could almost always be understood in the absence of diagrams, occupied twenty-five pages of the *Edinburgh Review* in the endeavor to describe its working, but gave several features up as a bad job. Another clever writer, Dr. Samuel Smiles, frankly shuns the task, and satisfies himself with the following brief description: —

"Some parts of the apparatus and modes of action are indeed extraordinary — and, perhaps, none more so than that for ensuring accuracy in the calculated results — the machine actually correcting itself, and rubbing itself back

into accuracy, by the friction of the adjacent machinery! When an error is made the wheels become locked and refuse to proceed; thus the machine must go rightly or not at all — an arrangement as nearly resembling volition as anything that brass and steel are likely to accomplish."*

Mr. Babbage, in 1822, entered upon the task of superintending the construction of a machine for calculating and printing mathematical and astronomical tables. He began by building a model, which produced forty-four figures per minute. The next year the Royal Society reported upon the invention, which appeared so promising that the Lords of the Treasury voted Mr. Babbage $7,500 to help him perfect his apparatus.

He looked about for a first-rate mechanician of high intelligence as well as of extreme manual skill. The man he wanted appeared in Mr. Joseph Clement, who had already made his name as the inventor of a drawing instrument, a self-acting lathe, a self-centring chuck, and fluted taps and dies. Mr. Clement soon produced special tools for shaping the various parts of the machine. So elaborate was the latter, that, according to Dr. Smiles, "the drawings for the calculating machinery alone — not to mention the printing machinery, which was almost equally elaborate — covered not less than four hundred square feet of surface!"

You will easily imagine, especially if you have ever had a special piece of apparatus made for you by a mechanic, that the bills mounted up at an alarming rate; so fast, indeed, that the Government began to ask, Why this great expense, and so little visible result? After seven years' work the engineers' account had reached $36,500, and Mr. Babbage had disbursed an additional $35,000 out of his own pocket. Mr. Clement quarreled with his employer — possibly because he harbored suspicions that they were both off on a wild-goose chase — and withdrew, taking all his valuable tools with him. The Government soon fol-

* *Industrial Biographies,* Chap. XIII.

## ASSEMBLING THE PARTS OF A CALCULATING MACHINE

Probably the most perfect calculating machine that is made is that very common object in every store, the cash register. So perfect is the machinery by which the interchangeable parts are made that the firm which constructs these cash registers turns out one complete machine every two and one-half minutes, adapted to the currency of almost every nation in the world.

lowed his example, and poor Babbage was left with his half-finished invention, "a beautiful fragment of a great work." It had been designed to calculate as far as twenty figures, but was completed only sufficiently to go to five figures. In 1862 it occupied a prominent place among the mechanical exhibits at the Great Exhibition.

We learn, with some satisfaction, that all this effort was not fated to be fruitless. Two scientists of Stockholm — Scheutz by name — were so impressed by Dr. Lardner's account of this calculating machine that they carried Babbage's scheme through, and after twenty years of hard work completed a machine which seemed to be almost capable of thinking. The English Government spent $7,500 on a copy, which at Somerset House entered upon the routine duty of working out annuity and other tables for the Registrar-General.

From Babbage's wonderfully and fearfully made machine we pass to a calculator which to-day may be seen at work in hundreds of thousands of shops and offices.

It is the most modern substitute for the open till; and, by the aid of marvelous interior works, acts as account-keeper and general detective to the money transactions of the establishment in which it is employed.

There are very many types of Cash Register, and as it would be impossible to enumerate them all, we will pass at once to the most perfect type of all, known to the makers and vendors as "Number 95."

This register has at the top an oblong window. Dotted about the surface confronting the operator are, in the particular machine under notice, fifty-seven keys; six bearing the letters A, B, D, E, H, K; three the words "Paid out," "Charge," "Received on Account;" and the others money values ranging from one cent up.

Everybody who goes into a store in any part of the country is familiar with the outside operation of the cash register.

But what has been going on inside the machine while it is being operated? Let us lift the cover, take off the case of the printing apparatus, and see.

A strip of paper fed through the printing mechanism has on it five rows of figures, letters, etc., thus —

| | | |
|---|---|---|
| | H | $1.00 |
| Pd. | A | .05 |
| | B | .25 |
| Rc. | K | 2.50 |
| Ch. | D | 3.00 |

The proprietor is, therefore, enabled to see at a glance (1) who served or attended to a customer, (2) what kind of business he did with him, (3) the monetary value of the transaction. At the end of the day each assistant sends in his separate account, which should tally exactly with the record of the machine.

Simultaneously with the strip printing, special counting apparatus has been (*a*) adding up the total of all money taken for goods (*b*) recording the number of times the drawer has been opened for each purpose. Here, again, is a check upon the records.

This ingenious machine not only protects the proprietor against carelessness or dishonesty on the part of his employees, but also protects the latter against one another. If only one drawer and letter were used in common, it would be impossible to trace an error to the guilty party. The lettering system also serves to show which assistant does the most business.

Where a cash register of this type is employed every transaction must pass through its hands — or rather mechanism. It would be risky for an assistant not to use the machine, as eyes may be watching him. He cannot open his drawers without making a record; nor can he make a record without first closing the drawers; so that he must give a reason for each use of the register. If he used somebody else's letter, the ear of the rightful owner would at once be attracted by the note of his particular gong. When going away for lunch, or on business, a letter can be locked by means of a special key, which fits none of the other five locks.

The printing mechanism is particularly ingenious. Every morning the date is set by means of index-screws:

and a consecutive numbering train is put back to zero. A third division accommodates a circular "electro" block for printing the advertisements, and a fourth division the figure wheels.

The turn given to the handle passes a length of the ticket strip through a slot—prints the date, the number of the ticket, an advertisement on the back, the assistant's letter, the nature of the business done, and feeds the paper on to the figures which give the finishing touch. A knife cuts off the ticket, and a special lever shoots it out of the slot.

The National Cash Register Company, for prudential reasons, do not wish the details of the internal machinery to be described; nor would it be an easy task even were the permission granted. So we must imagine the extreme intricacy of the levers and wheels which perform all the tasks enumerated, and turn aside to consider the origin and manufacture of the register, which are both of interest.

The origin of the cash register is rather nebulous, because about thirty years ago several men were working on the same idea. It first appeared as a practical machine in the offices of John and James Ritty, who owned stores and coal mines at Dayton, Ohio. James Ritty helped and largely paid for the first experiments. He needed a mechanical cashier for his own business, and says that, while on an ocean steamer en route to London the revolving machinery gave him the suggestion worked out, on his return to Dayton, in the first dial-machine. This gave way to the key-machine with its display tablet, or indicator, held up by a supporting bar moved back by knuckles on the vertical tablet rod.

Mr. John Ritty gives an account differing from that of his brother; but the two can probably be reconciled by supposing that the first ideas occurred simultaneously and were worked out in common.

Late one summer night, before dispersing for home, a group of men were in his store. One of them said to the proprietor, "If you had a machine there to register the

cash received, you would get more of it," and to the statement both owner and his clerks assented. This raised a laugh. But Ritty who, in spite of a large business, which ranged over everything from a needle to a haystack, did not make much profit by his sales, took the suggestion seriously, and put on his thinking-cap, with the result that the first machine was patented, and profits became very greatly increased.

Before his machine had been perfected a rival was in the field. Mr. Thomas Carney, a man who had seen much life as a lumber merchant, captain during the Civil War, explorer, and railroad promoter, settled down in 1884, at Chicago, to the manufacture of coin-changers. "When in various businesses," he says, "we used gold and silver only, and it seemed to be a sheer necessity to have something of a money-changer to assist us in handling it and making change. The custom then was to throw the different coins into a special receptacle marked for each. I invented, and in my own shop built this coin-changer, the keys of which, when touched, would, through the tube, drop the coin into the hand as wanted. At Chicago we made five or six hundred of these coin-changers, but by mistake placed the price too low, and after some conference I became assured that there was not enough money in it. A rich Chicago manufacturer had become familiar with the urgent need of a cash register, and the losses which followed in business without one. The National, at Dayton, had then been invented, but had not then been perfected as it has been since. Parties at Chicago agreed to put up the money if I would invent what would answer the purpose of a cash register and make a marketable machine. I went home and gave the matter some hard thinking, and talking with my son about the matter one night, I looked up at the clock and said, 'Why, Harry, there is the right thing. Sixty minutes make an hour; one hundred cents make a dollar. All I have got to do is to change the wheels a little, put some keys into it, and there will be a thing which will register cents, dimes, and dollars, just as that clock will register time in minutes

and hours.' In clocks the minute wheel, when it has revolved to its sixty point, throws its added result of sixty minutes over on to another wheel, which takes up the story, with one hour in place of the old sixty minutes. The first wheel then begins again and goes its round. A second complete revolution of the minute wheel throws another sixty minutes on to the hour, and gives one more hour registered, making two hours, and so on. I took some wheels, and with pasteboard made hands and a machine. It was very rough, but I took it to my friends and explained it to them. We went on, but encountering difficulties and obstacles, we merged our whole enterprise in the National. I followed it, and have since invented, worked, and helped along in the National Cash Register service. I developed the No. 35 machine which the company began on and uses yet. It is now in use in every civilized country, for it can be made to register English money and any decimal currency.''

In 1803 Dayton contained five families. The following year Colonel Robert Patterson bought a large property in the neighborhood, and helped to develop a small town, which has since grown into a thriving manufacturing centre. His two sons, John H. Patterson and Frank J. Patterson, brought out all the original proprietors of the National Cash Register, greatly improved the machine's mechanism, and built the huge factory which employs about 4,000 men, women, and girls, and is one of the best-equipped establishments in the world to promote both an economical output and the comfort of the employees. The Company's buildings at Dayton cover 892,144 square feet of floor space, and utilize 140 acres of ground. In convenience and attractiveness, and for light, heat, and ventilation, and all sanitary things, these structures are designed to be models of any used for factory purposes. A machine is made and sold every 2½ minutes in the Dayton, Berlin, and Toronto factories collectively. According to its destination, it records dollars, shillings, marks, kronen, korona, francs, kroner, guldens, pesetas, pesos, milreis, rupees, or rubles. Registers are also made to meet the needs of the Celestials and the Japanese.

So necessary is it for these machines to be ever improving, that the Company, with a wisdom that prevails more largely, perhaps, in the United States than elsewhere, offer substantial rewards to the employee who records in a book kept specially for the purpose any suggestion which the committee, after due examination, consider likely to improve some detail of mechanism or manufacture. Five departments are entirely devoted to experiments carried out by a corps of inventors working with a special body of skilled mechanics. New patents accrue so fast as a result of this organized research that the National Company now owns 537 letters patent in the United States and 394 in foreign countries.

Many ideas come from outside. If they appear profitable they are bought and turned over to the Patents Department, which hands them on to the experimenters. These build an experimental model, which differs in many respects from the types hitherto manufactured. A cash register must be above all things strong, so that it can bear a heavy blow without getting out of order, and must retain its accuracy under all conditions.

The model finished, it goes before the inspectors, who thump it, hammer it, almost turn it inside out, and send it back to the Factory Committee with reports on any defects that may have come to light. If the inspectors can only knock the machine out of time they consider that they have done their duty; for they argue that, if weaknesses thus developed are put right, no purchaser will ever be able to dislocate the machinery if he stops short of an actual "brutal assault with violence."

Next comes the building of the commercial type, which will be sold by the thousand. The machine goes down to the tool-makers, a select board of seventy-five members, who list all the parts, and say how many drill-jigs, mills, fixtures, gauges, etc., are necessary to make every part. Then they draw out an approximate estimate of the cost of producing the tools, and after they have listed the parts, they turn them over to the various departments, such as the drafting-room, blacksmiths' shop, pattern

shop, foundry, etc., after which the various parts are machined up. Then the tool-maker assembles together the various tools, and makes a number of the parts that each tool is designed for; so that when all the tools have done their preliminary work, the makers possess about fifty machines "in bits." These are assembled, to prove whether the tools do their business efficiently. If any part shows an inclination "to jam," or otherwise misbehave itself, the tool responsible is altered till its products are satisfactory.

Then, and only then — a period of perhaps two years may have elapsed since the model was first put in hand — the Company begins to entertain a prospect of getting back some of the money — any sum up to $250,000 — spent in preparations. But they know that if people will only buy, they won't have much fault to find with their purchase. "Preparation bring success" is the motto of the N. C. R. So the Company spares no money, and is content to have $125,000 locked up in its automatic screw-making machines alone.

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## ELECTRICITY AND MAGNETISM.

BY

CHARLES R. GIBSON,

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### WHAT IS ELECTRICITY?

ALMOST the whole of our knowledge concerning electricity has been acquired during the last few generations, and the varied practical purposes to which it has been applied are all of so recent a date that electricity itself has come to be vaguely thought of by some as one of our modern inventions. Some people

From "The Romance of Modern Electricity." London.

have even a hazy idea that our electric power stations are busy manufacturing a mysterious material fluid, called electricity, in something the same sense as one may speak of a gas-work producing gas.

In the minds of most people there is a mysterious vagueness in connection with all thoughts about electricity. We must picture it as a material fluid in order to think conveniently of it, and yet we know it is not a something which we can lay our hands on. It will be sufficient for our present purpose to try and form some conception as to the general nature of that which has come to be called electricity. Let us suppose that we are endowed with the respiratory organs of amphibious animals, and let us go, in our imaginations, to the bottom of the ocean. We find ourselves surrounded with water, and we notice that by moving our arms rapidly through the water we can disturb it, and as we become accustomed to our environment we find that we are able to set up quite a variety of disturbances in this surrounding medium.

Coming back to real life, we may, in a similar way, imagine ourselves immersed in a great ocean of "something" which we do not understand, but to which scientists have given the name of the ether. (This word, of course, has no connection whatever with the ether obtained from alcohol and used as an anæsthetic.) We are able, by many different means, to set up disturbances in this ether of space, and, for the present, we may consider the word electricity to mean a disturbance of this ether, and look upon electric batteries and dynamos merely as pumps for affecting this ether ocean.

We really know nothing as to the nature of this ether, so that it would not be unreasonable for an outsider to suggest that the ether itself might be merely a myth, or an entirely mistaken idea, in the mind of the scientist. To the scientist the ether is as real as the air he breathes, although its nature is shrouded in mystery; its presence must become real to every thoughtful person.

If two men are walking along a road, one in front of the other, and the one immediately behind wishes to com-

municate with his friend, he might touch him on the shoulder and thus make his arm a medium of connection between them; or, if he happened to be a few feet farther distant, he might tap him on the leg with his walking-stick, and so on. If the distance apart were still greater, and the man were sure of his friend's good temper, he might throw some object at him, but in each case the medium of communication would be very apparent. If the distance were still increased the one man might still communicate with the other by shouting or whistling, thus using the air as a medium between them. From a distance beyond earshot he might still attract his friend's attention by waving his arms, provided his friend's eyes were not turned away from him.

In the last mentioned case there must have been some medium, other than the air, between the two men. If you hold a loose electric lamp bulb between you and the window you receive light through the bulb, though it contains no air. We receive light from the sun across a space of more than ninety millions of miles, and our atmosphere only extends, at most, a few hundred miles, There must be some medium between us and the sun.

If a man is standing upon the seashore and looking out to sea he observes a steamer moving along, followed by a large sailing ship which, having no sails set, still keeps pace at constant distance behind the steamer. He at once concludes that there is some medium of connection between the two vessels, although he sees no signs of any, and his experience suggests a rope or cable. Surely when we see a magnetic needle follow the direction in which it is led by a neighboring magnet our reason insists that there must be some medium of communication between them, and it is to this medium that scientists have given the name of the ether.

While the existence of the ether was only established about a century ago, it is interesting to note what Sir Isaac Newton suggested a century earlier than that date: "Perhaps the whole frame of nature may be nothing but various contextures of some certain ethereal spirits or

vapors . . . wrought at first by the immediate hand of the Creator and ever after by the power of nature."

You will picture the ether as a vast ocean, not merely filling all space, but permeating all bodies, no matter how solid. A piece of hard steel will be thought of as having its molecules all grouped together and being, on an infinitely small scale, analogous to a heap of cannon balls; and just as there would be air around each cannon ball, so will the ether be among the molecules of steel.

It is impossible for us to really think of this ether as being immaterial in the sense in which that word is commonly used, but we must realize that it is something quite different from ordinary matter. One cannot think of anything immaterial without using some material symbol, and Sir Oliver Lodge has suggested that we should picture the ether as a continuous jelly.

If anyone puts his head out of the window of a railway train, traveling at a high speed, the great resistance offered by the air to his passage through it is most apparent. The ether certainly offers no such resistance, for, standing at the earth's equator, a man is flying round and round with this great rotating globe through the ether at a speed more than ten times greater than an express train, and yet our world is not quickly slowing down, as it certainly would be if offered any resistance by the ether.

A more impressive picture may be obtained by thinking, first of all, of the great resistance offered by our atmosphere to the descent of meteors which reach it daily in shoals, traveling at a speed more than one thousand times that of an express train. Even away up near the limit of our atmosphere, where the air is very thin indeed, so much resistance is offered to these meteors that they quickly incandesce and dissipate. In our journey with this earth around the sun, we are traveling through the ether at a speed very similar to that of the meteor, and yet we suffer no inconvenience. It must therefore be clear to us that whatever the ether may be it is quite frictionless, and is, therefore, something quite distinct

from ordinary matter. It is, no doubt, needless to remark that our atmosphere is flying through the ether with us, the air being acted upon by gravitation just as we ourselves are, and a very good thing for us that it keeps pace with us.

I can imagine someone saying that if he were assured that this ether had weight, be it ever so little, he could then give it a place among the realities of life. It is quite clear, however, that the ether has no weight, or it would offer some resistance to any disturbance in it. Can anything really exist and yet have no weight whatever? All matter certainly has weight, but what do we mean by having weight? We may say that weight is the measure of gravitation, or the attraction between any body and the earth, but we must keep in mind the larger fact that every particle of matter attracts every other particle, and that this attractive power between even very small objects may be measured by delicate apparatus. The amount of attraction between two bodies of even moderate size is, of course, quite negligible as compared with the effect of the vast mass of our globe on all other bodies on, or near, its surface.

It is not necessary for our present purpose that we try to form any definite conception of what gravitation may be, but let us, for the nonce, suppose that the attractive power between two bodies is due to some internal motion in the small particles, or atoms of matter, and that this motion is common to all atoms of matter. We then agree, for the sake of our mental picture, that it is this motion which gives to matter the attractive power, or what we call weight, and it must be clear to us that if this motion were absent from whatever matter is made of, then the attractive power would not exist, so that the "something" without this motion would not be matter, and would not have weight. If we picture this "something" as being the ether we can then imagine the ether as having no weight, but if it be given the necessary motion it may become what we call matter.

The most recent theory, known as the electric theory of matter, supposes the ether as the fundamental basis, and that, given certain motions, it forms "atoms" of electricity, and that it is the grouping together of myriads of these that forms an atom of matter. It will however be sufficient to picture electricity as being a disturbance of the ether, and it will be convenient to think of electricity as analogous to a mysterious fluid, while we keep in mind that we are merely doing so as an aid to thought.

We have also the ether disturbances known as "light" and "radiant heat," which are intimately connected with what we call electricity. It is possible that many of us may live to see one scientific name denote all ether disturbances, including the phenomena of cohesion and gravitation.

The unsolved problem of the present day is not so much that indicated by the query "What is Electricity?" as the more fundamental question — What is the ether?

### WHAT IS MAGNETISM?

From our childhood we have all had some knowledge of magnetism in connection with the compass needle, and no doubt many of us gained further knowledge from magnetic toys presented to us to enable us to become expert anglers. In any case it is scarcely necessary to remark that a magnet attracts iron, or that a light magnet balanced upon a pivot will have one end or "pole" pointing north and the other south.

There is a third and a very remarkable property of magnets; a simple one and yet one that often leads to confusion. Every magnet has, of course, a north and a south-seeking end or "pole," and these two ends are usually brought close together by making the magnet in a horseshoe form, in order to have the attractive pull of both poles combined. It is more convenient for experimental purposes to make the magnet in the form of a straight bar, so that the effect of each pole may be examined by itself. In order to distinguish the poles it is

customary to mark the north-seeking pole with the letter N, or to paint that end or mark it in some way so that it is quite easy to discern the north pole, while the plain end is, of course, the south.

If the north pole of a bar-magnet be brought near to the north pole of a magnetic needle pivoted upon a stand, the north pole of the needle will fly away from the north pole of the bar-magnet, but the south pole will come round and be attracted. The south pole of the magnet and the south pole of the needle will also repel each other, but the two unlike poles will always attract one another. This is certainly very strange — the poles all look exactly alike and they will all attract iron equally well, but their behavior towards each other is so different; the norths will have nothing to do with the norths, the souths are equally repellent to one another, but a north and a south are always attractive to each other.

If two north poles repel each other, how, then, is the north pole of a compass needle attracted by the north pole of the earth? In point of fact the end of the compass needles pointing to the north is of opposite polarity, but it would be confusing to call this north-pointing end a "south" pole, although the Chinese and the French have done so. We prefer to call it the north-seeking pole, or, in short, the north pole, but it must be remembered that the true meaning is the north-pointing or seeking pole. One does not see any magnet in the modern mariner's compass, as the compass card itself is pivoted at its centre, and has a number of small magnets fixed to its underside, so that the card itself takes up its correct position, indicating the different cardinal points. In this way there can be no confusion, as was sometimes the case previously when an inexperienced person could not tell whether the painted or the plain end of the needle was the north-seeking pole.

If two bar-magnets are used together, having the two north poles and the two south poles respectively touching each other, then a more powerful magnet is the result, as one would quite anticipate. If, however, the relative

position of the magnets to each other be reversed, so that a north pole and a south pole lie in contact at each end, all trace of magnetism disappears. One cannot now even lift a small iron nail with these two magnets, but when separated again they are each just as attractive as before. We have almost ceased to wonder at this strange fact, but it is none the less remarkable for that, and the peculiar behavior of these magnetic poles to each other is of the very greatest importance to us in practice.

While the early experimenters had been able to make magnets by rubbing pieces of iron with a natural magnet or lodestone, and while they also had observed a piece of "rubbed" amber attracting light bodies to it, there is doubt if it ever occurred to them that there might be any connection between magnetism and electricity. Later on the idea did become definite, and in the year 1819 Hans Christian Oersted, a Danish professor, found that a magnetic needle when brought near to a copper wire carrying a current of electricity behaved in a strange fashion. The magnet found the wire of more attraction than the north and south poles of the earth, so that it would no longer act as a compass needle while it remained in the neighborhood of an electric current. If the magnet is placed above or below the wire, the magnet will swing round and take up a position at right angles to the wire. Whether the north pole of the magnet comes out to the right hand or to the left hand depends upon the direction in which the current is flowing in the wire.

For the present it will be sufficient to note that if we send the current along the wire in one direction the north pole of the needle swings out to the right hand, and when we send the current in the opposite direction the north pole of the needle turns out to the left hand.

The needle and the wire may be fixed in a vertical or upright position, and the result is the same. If instead of a single wire passing above or below the needle the wire be continued round and round to form a coil, the result is greatly enhanced. This exceedingly strange attitude

of the magnet towards the electric current is of immense importance to us.

After this connection between electricity and magnetism had been discovered, experimenters would naturally wonder if the current had any effect upon iron that had not been magnetised. Very soon a French scientist, François Arago, was able to show that the wire carrying an electric current did affect small filings of iron. The filings each appeared to become a little magnet, and if a quantity of filings was placed in a glass tube and a strong current was sent through a wire wound around the tube, the tube of filings became quite an appreciable magnet. If a piece of soft iron, instead of a tube of filings, was placed inside the coil of wire carrying a current, the iron became quite a powerful magnet, but as soon as the current ceased in the wire the magnetism disappeared too.

If one takes an ordinary kitchen poker and wraps an insulated wire round and round it from one end to the other, whenever the two ends of the wire are connected to a battery the poker becomes a powerful magnet, and will support pieces of iron, such as keys, scissors, nails, etc. As soon as the current is stopped in the wire by disconnecting it from the battery, down tumble all the objects, for the magnetism has vanished from the poker. Here we have a most useful kind of magnet, which will attract or let go at will; and such magnets or electro-magnets are of the very greatest importance to us in telegraphs, telephones, dynamos, motors, etc.

Electro-magnets are made of soft iron, but if hard steel were substituted inside the coil of wire, the steel would be much slower in replying to the influence of the current, and when the current was stopped it would be found that the magnetism remained, and the wire could then be removed. The steel magnets thus made are called permanent magnets, to distinguish them from electro-magnets, which are merely temporary. The magnetic needle in the compass is of course a steel magnet, as also were the toy magnets of our youth.

Iron, like all other substances, is built up of very small

particles, called molecules, which are so exceedingly small that they are far beyond the reach of the most powerful microscopes. Of course, we must magnify these molecules immensely in our minds when we think of them, no matter how small we try to picture them.

Each of these molecules of iron is itself a tiny magnet, having of necessity a north and a south pole. In the iron these are all lying higgledy-piggledy, the pull of one counteracting the pull of another, so that no trace of magnetism is found in the iron.

It has already been shown that a magnet inside a coil of wire will turn round and set itself at right angles to the coil whenever a current of electricity is passing in the wire. Therefore, each molecule in the iron core of the electro-magnet will behave in the same fashion, for each molecule being a tiny magnet will turn round and set itself at right angles to the wire, with its north pole in one direction and its south pole in the opposite direction. All the combined north poles of these midget magnets now acting together produce a very effective power of attraction, as also do the united forces of the south poles. Thus at the one end of an electro-magnet is found a north pole and at the other end a south pole, no matter whether the magnet be a straight bar or bent in horseshoe form.

It is quite reasonable to suppose that in hard steel these tiny molecules are so firmly bound together that when the current once gets them turned round they cannot readily swing back again, in which case we have a permanent magnet. On the other hand, in soft iron the molecules will reply much quicker to the controlling current, but will only remain with their north poles all in one direction as long as the neighboring current holds them there; as soon as the current is withdrawn they swing back to their normal higgledy-piggledy condition.[1]

One may imagine the turning on of the current to be, in military parlance, the command of "Eyes front" to

[1]It is not necessary to suppose a real topsy-turvy condition, for if the tiny magnets were forming complete magnetic chains or rings the absence of any outward effect would be just the same.

this regiment of molecules; the withdrawal of the current to be the "Stand at ease" or "Stand easy."

If this generally accepted theory of magnetism be correct, then one can foresee what will happen if a so-called permanent steel magnet be raised to a red heat. As its molecules will be set in rapid vibratory movement they will be given an opportunity of freeing themselves from the artificial position into which they were forced by the effect of the electric current. This exactly corresponds with what does take place, for no trace of magnetism is found in the "permanent" magnet when it has been thoroughly heated. For the same reason one must be careful not to knock these steel magnets about, for by hammering them one may assist the molecules back to their normal positions.

Strange to say, when a piece of iron rod is magnetized it becomes longer and thinner, but this is quite in keeping with a turning movement provided the molecule is of irregular shape. The metals nickel and cobalt are also magnetic substances, and indeed it appears as though all matter is more or less magnetic, but iron stands out head and shoulders above all other materials in its magnetic properties. It has been found possible, however, to produce alloys of copper, manganese, and aluminiums, which have proved much more magnetic than nickel and cobalt, though falling far short of iron.

It is quite possible to magnetize a piece of steel by the earth's influence, if the metal is placed in a definite position in relation to the magnetic poles of the earth and then hammered in order to give the molecules an opportunity of getting into position. Steel railings after standing for many years in one position have often been found to be quite appreciable magnets, as also have steel rails of a railway track.

### HOW MAGNETISM IS RELATED TO ELECTRICITY.

When magnetism and electricity were at first known there was not supposed to be any connection between them; then for a time they were treated as sister sciences,

while now one would feel it more natural to have but one scientific name to distinctly include both.

We have seen that an electric current flowing in a wire around a piece of iron produced magnetism in the iron. If the iron is withdrawn altogether, it will be found that the coil of copper wire is itself a magnet, as long as the current flows in it.

If a light coil of fine insulated copper wire be freely suspended, and attached to a battery, it will be found that the coil, with the current passing through it, behaves exactly like an iron magnet. One face of the coil will be attracted by the north pole of a bar-magnet, while the other face will be repelled, showing that the coil has a south and a north pole. When a piece of iron is placed inside the coil the effect is greatly increased.

A long cylindrical or helical coil of copper wire, delicately balanced, and carrying an electric current, would act as a compass needle, but would, of course, be of no practical service in comparison with a simple magnetic needle.

The fact that an electric current sets up a disturbance in the surrounding ether, which is termed "a magnetic field," should now be clear, but the relationship does not cease here, for the converse is also true.[1]

Some seventy years ago the great British scientist, Michael Faraday, discovered that when a coil of wire was quickly moved between the poles of a magnet, an electric current was set up in the wire at each movement.

We have all seen this experiment repeated in those small magneto-electric machines, in which one drives a coil of wire round in the magnetic field of a permanent magnet. Such machines are sometimes used for medical purposes, but perhaps more often for amusement.

This very simple little experiment of Faraday's in time gave birth to our gigantic dynamos and motors, and when we think of all that these mean we shall surely not fail to

[1] The word "field" here merely means sphere of influence.

put a true measure of value upon the patient research work of scientific men.

The coil of wire carrying an electric current is not an electrified body. One may picture an electrified body as having a charge of electricity at rest in a strained condition, while a body conveying a current has electricity in motion.

In the molecular theory of magnetism, already briefly explained, it is obvious that the question as to what magnetism is has only been answered in part. This theory does not go to the root of the matter, as it sets out with the assumption that each molecule of iron is itself a magnet. Where does the molecule's magnetism come from? It is supposed that there is electricity in rotation in the ether of the molecule, and that it is this motion which furnishes the attractive force. As this motion is in the ether, which, as already explained, offers no frictional resistance whatever, the motion is perpetual. We are so accustomed to seeing all bodies once put in motion coming to rest again, that it is difficult for us to think of a perpetual motion of this nature. We must allow however, that anything we have seen in motion upon this earth has always been brought to rest by obstruction or frictional resistance. Visible exponents of perpetual motion are clearly seen in the heavens. Our faithful moon makes her ceaseless journey around the earth, while our world itself, along with the seven other gigantic planets, performs a continuous waltz around the sun. Again the whole vast solar system is bodily on the move, traveling probably at a speed of one thousand miles per minute, and these motions are certainly all perpetual as far as man is concerned. If one realizes those gigantic and continuous motions, the mind need not be staggered with the thought of perpetual rotation of electricity in the molecule.

There is one point I would like to remark upon in this connection. Surely this perpetual motion in the molecule must be incapable of interruption as far as we are concerned. In considering the fact that a piece of iron at

a white heat cannot be magnetized, some scientists tell us that the electrical rotation in the molecule ceases, but is again set in motion as the body comes down in temperature. Can one imagine the perpetual motion of the planets being stopped and restarted? It seems to me as unreasonable to suppose the perpetual motion in the molecule being tampered with. May we not rather imagine the molecules, with their rotating ether intact, to be in such rapid vibratory motion, at such a high temperature, that they have for the time become uncontrollable by the outside current which is endeavoring to turn them round?

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## STORY OF THE ATLANTIC CABLE.

BY

CYRUS WEST FIELD.

The following is taken from a speech made by Cyrus W. Field at a banquet given him in New York in 1866 to celebrate the final completion and successful working of the first Atlantic Cable.

IT is nearly thirteen years since half a dozen gentlemen of this city met at my house for four successive evenings and around a table covered with maps and charts and plans and estimates, considered a project to extend a line of telegraph from Nova Scotia to St. John's, in Newfoundland, thence to be carried across the ocean. It was a very pretty plan on paper. There was New York and there was St. John's, only about twelve hundred miles apart. It was easy to draw a line from one point to the other—making no account of the forests and mountains and swamps and rivers and gulfs that lay in our way. Not one of us had ever seen the country or had any idea of the obstacles to be overcome. We thought we could build the line in a few months. It took two years and a half. Yet we never asked for help outside our own little circle. Indeed, I fear we should

not have got it if we had, for few had any faith in our scheme. Every dollar came out of our own pockets. Yet I am proud to say no man drew back. No man proved a deserter; those who came first into the work have stood by it to the end.

"From this statement you will perceive that in the beginning this was wholly an American enterprise. It was begun and for two years and a half was carried on solely by American capital. Our brethren across the sea did not even know what we were doing away in the forests of Newfoundland. Our little company raised and expended over a million and a quarter of dollars before the Englishmen paid a single pound sterling. Our only support outside was in the liberal charter and steady friendship of the Government of Newfoundland for which we were greatly indebted to Mr. E. M. Archibald, then attorney-general of that colony, and now British consul in New York. And in preparing for an ocean cable, the first soundings across the Atlantic were made by American officers in American ships. Our scientific men — Morse, Henry, Bache, and Maury — had taken great interest in the subject. The United States ship 'Dolphin' discovered the telegraph plateau as early as 1853; and the United States ship 'Arctic' sounded across from Newfoundland to Ireland in 1856, a year before Her Majesty's ship 'Cyclops,' under command of Captain Dayman, went over the same course. This I state not to take aught from the just praise of England but simply to vindicate the truth of history.

"It was not till 1856 — ten years ago — that the enterprise had any existence in England. In that summer I went to London and there organized the Atlantic Telegraph Company. Science had begun to contemplate the possibility of such an enterprise; and the great Faraday cheered us with his lofty enthusiasm. Then, for the first time, was enlisted the support of English capitalists; and then the British Government began that generous course which it has continued ever since — offering us ships to complete soundings across the Atlantic and to assist in

laying the cable, and an annual subsidy for the transmission of messages. The expedition of 1857, and the two expeditions of 1858 were a joint enterprise in which the 'Niagara' and the 'Susquehanna' took part with the 'Agamemnon,' the 'Leopard,' the 'Gorgon' and the 'Valorous;' and the officers of both navies worked with generous rivalry for the same great object. The capital — except one-quarter which was taken by myself — was subscribed wholly in Great Britain. The directors were almost all English bankers and merchants. Though among them was one gentleman whom we are proud to call an American, Mr. George Peabody, a name honored in two countries, since he showered his princely benefactions upon both — who, though a resident for nearly forty years in London, where he has gained abundant wealth and honors, still clings to the land of his birth; declining the honor of a baronetcy of the United Kingdom to remain a simple American citizen.

"With the history of the expeditions of 1857–58 you are familiar. On the third trial we gained a brief success. The cable was laid, and for four weeks it worked, though never very brilliantly, never giving forth such rapid and distinct flashes as the cables of to-day. It spoke, though only in broken sentences. But while it lasted no less than four hundred messages were sent across the Atlantic. You all remember the enthusiasm which it excited. It was a new thing under the sun, and for a few weeks the public went wild over it. Of course, when it stopped the reaction was very great. People grew dumb and suspicious. Some thought it was all a hoax, and many were quite sure that it never worked at all. That kind of odium we have had to endure for eight years until now I trust we have at last silenced the unbelievers.

"After the failure of 1858 came our darkest days. When a thing is dead it is hard to galvanize it into life. It is more difficult to revive an old enterprise than to start a new one. The freshness and novelty are gone and the feeling of disappointment discourages further effort.

Other causes delayed the new attempt. This country had become involved in a tremendous war; and while the nation was struggling for life it had no time to spend in foreign enterprise.

"But in England the project was still kept alive. The Atlantic Telegraph Company kept up its organization. It had a noble body of directors who had faith in the enterprise and looked beyond its present low estate to ultimate success.

"All this time the science of submarine telegraphy was making progress. The British Government appointed a commission to investigate the whole subject. This commission sat for nearly two years and spent many thousands of pounds in experiments. The result was a clear conviction in every mind that it was possible to lay a telegraph across the Atlantic. Science was also being all the while applied to practice. Submarine cables were laid in different seas — in the Mediterranean, in the Red sea, and the Persian gulf. The latter was laid by my friend, Sir Charles Bright, who thus rendered another service to his country and gained a fresh title to the honor which was conferred upon him for his part in laying the first Atlantic cable.

"When the scientific and engineering problems were solved we took heart again and began to prepare for a fresh attempt. This was in 1863. In this country — though the war was still raging — I went from city to city holding meetings and trying to raise capital, but with poor success. Men came and listened and said, 'it was all very fine,' and 'hoped I would succeed,' but did nothing. In one of the cities they gave me a large meeting and passed some beautiful resolutions and appointed a committee of 'solid men' to canvass the city, but I did not get a solitary subscriber! In this city I did better, though money came by the hardest work. By personal solicitations I succeeded in raising $350,000. But at the time I speak of, it was plain that our main hope must be in England, and I went to London. There too, it dragged heavily; there was a profound discouragement. Many

had lost before and were not willing to throw more money into the sea. We needed $3,000,000, and with our utmost efforts we had raised less than half, and there the enterprise stood in a deadlock. It was plain that we must have help from some new quarter. I looked around to find a man who had broad shoulders and could carry a heavy load, and who would be a giant in the cause. It was at this time I was introduced to a gentleman whom I would hold up to the American public as a specimen of a great-hearted Englishman, Mr. Thomas Brassey, in London, known as one of the men who have made British enterprise and Britain capital felt in all parts of the earth. I went to see him, though with fear and trembling. He received me kindly, but put me through such an examination as I never had before. I thought I was in the witness-box. He asked every possible question, but my answers satisfied him, and he ended by saying that 'it was an enterprise which ought to be carried out and that he would be one of ten men to furnish the money to do it.' This was a pledge of $300,000! Encouraged by this noble offer I looked about to find another such man, though it was almost like trying to find two Wellingtons. But he was found in Mr. John Pender, of Manchester. I went one day to his office in London and we walked together to the House of Commons, and before we got through he said he would take an equal share with Mr. Brassey.

"The action of these two gentlemen was a turning-point in the history of our enterprise, for it led shortly after to a union of the well-known firm of Glass, Elliott & Company with the Gutta-Percha Company, making of the two one grand concern, which included not only Mr. Brassey and Mr. Pender, but other men of great wealth, such as Mr. George Elliott, and Mr. Barclay, of London, and Mr. Henry Bewley, of Dublin, and which thus reinforced with immense capital took up the whole enterprise in its strong arms. We needed, I have said, $3,000,000, and with all our efforts in England and America we had raised only $1,425,000. This new company now came

forward and offered to take up the whole remaining $1,575,000 besides $500,000 of the bonds and to make its own profits contingent on success! Mr. Richard A. Glass was made Managing Director, and gave energy and vigor to all its departments, being admirably seconded by the Secretary, Mr. Shuter. Mr. Glass has been knighted for his services in carrying out the Atlantic Telegraph — an honor which he most justly deserves.

"A few days after, half a dozen gentlemen joined together and bought the 'Great Eastern' to lay the cable. At the head of this company was placed Mr. Daniel Gooch, member of Parliament and chairman of the Great Western Railway, who was with us in both expeditions which followed, and who for his services has been made a baronet of the United Kingdom.

"The good fortune which favored us in our ship favored us also in our commander. Many of you know Captain Anderson who was for years in the Cunard line. You may have crossed the sea with him, and you remember how kind he was; how clear-eyed and prompt in his duty, and yet always a quiet and modest gentleman. How well he did his part in two expeditions the result has proved, and it was just that a mark of royal favor should fall on that manly head.

"Thus organized, the work of making the new Atlantic cable was begun. The core was prepared with infinite care under the able superintendence of Mr. Chatterton and Mr. Willoughby Smith; and the whole was completed in about eight months. As fast as ready it was taken on board the 'Great Eastern' and coiled in three enormous tanks; and, on July 15, 1865, the ship started on her memorable voyage.

"For a week all went well; we had paid out twelve hundred miles of cable and had only six hundred miles further to go when, hauling in the cable to remedy a fault, it parted and went to the bottom! That day I can never forget — how men paced the deck in despair looking out on the broad sea that had swallowed up their hopes; and then how the brave Canning for nine days and nights

dragged the bottom of the ocean for our lost treasure, and though he grappled it three times, failed to bring it to the surface. The story of that expedition as written by Dr. Russell, who was on board the 'Great Eastern,' is one of the most marvelous chapters in the whole history of modern enterprise. We returned to England defeated yet full of resolution to begin the battle anew. Measures were at once taken to make a second cable and to fit out a new expedition; and with that assurance I came home last autumn.

"In December I went back again, when lo, all our hopes had sunk to nothing. The Attorney-General, of England, had given his written opinion that we had no legal right without a special Act of Parliament (which could not be obtained under a year) to issue the new twelve per cent. shares on which we relied to raise our capital. This was a terrible blow. The works were at once stopped and the money which had been paid in returned to the subscribers. Such was the state of things only ten months ago. I reached London on December 24, and the next day was not a 'Merry Christmas' to me. But it was an inexpressible comfort to have the counsel of such men as Sir Daniel Gooch and Sir Robert A. Glass; and to hear stout-hearted Mr. Brassey tell us to go ahead; and if help were needed he would put down $300,000 more! It was finally concluded that the best course was to organize a new company which should assume the work; and so originated the Anglo-American Telegraph Company. It was formed by ten gentlemen who met round a table in London and put down $50,000 apiece. I hope the excellent Secretary of this company, Mr. Dean, who came with us across the ocean, will write its history and tell the world what life and vigor were comprised in its board of directors. The great telegraph construction and maintenance company, undaunted by the failure of last year, answered us with a subscription of $500,000; soon after the books were opened to the public through the eminent banking house of J. S. Morgan & Company, and in fourteen days we had raised the whole $3,000,000. Then

the work began again and went on with speed. Never was greater energy infused into any enterprise. It was only the first day of March that the new company was formed and it was registered as a company the next day; yet such was the vigor and despatch that in five months from that day the cable had been manufactured, shipped on the 'Great Eastern,' stretched across the Atlantic, and was sending messages literally swift as lightning from continent to continent.

"Yet this was not a 'lucky hit'—a fine run across the ocean in calm weather; it was the worst weather I ever knew at that season of the year. We had fogs and storms almost the whole way. Our success was the result of the highest science combined with practical experience. Everything was perfectly organized to the minutest detail. We had on board an admirable staff of officers, such men as Halpin and Beckwith; and engineers long used to this business, such as Canning and Clifford, and Temple, the first of whom has been knighted for his part in this great achievement; and electricians such as Professor Thomson, of Glasgow, and Willoughby, Smith, and Laws; while Mr. C. F. Varley, our companion of the year before, who stands among the first in knowledge and practical skill, remained with Sir Robert Glass, at Valentia, to keep watch at that end of the line, and Mr. Latimer Clark, who was to test the cable when done. Of these gentlemen, Professor Thomson, as one of the earliest and most eminent electricians of England, has received some mark of distinction. England honors herself when she thus pays honor to science; and it is fitting that the Government which honored chemistry in Sir Humphrey Davy should honor electrical science in Sir William Thomson.

"But our work was not over. After landing the cable safely at Newfoundland we had another task, to return to mid-ocean and recover that lost in the expedition of last year. This achievement had perhaps excited more surprise than the other. Many even now 'don't understand it;' and every day I am asked 'how it was done.' Well, it does seem rather difficult—to fish for a jewel at

the bottom of the ocean two and a half miles deep, but it is not so very difficult — when you know how. You may be sure we did not go fishing at random, nor was our success mere 'luck' — it was the triumph of the highest nautical and engineering skill. We had four ships and on board of them some of the best seamen in England, men who knew the ocean as a hunter knows every trail in the forest. There was Captain Moriarty, who was in the 'Agamemnon' in 1857–58. He was in the 'Great Eastern' last year and saw the cable when it broke; and he and Captain Anderson at once took their observations so exact that they could go right to the spot. After finding it, they marked the line of the cable by a row of buoys; for fogs would come down and shut out sun and stars so that no man could take an observation. These buoys were anchored a few miles apart. They were numbered, and each one had a flag-staff on it, so that it could be seen by day, and a lantern by night.

"Thus having taken our bearings we stood off three or four miles so as to come broadside on, and then casting over the grapnel we drifted slowly down upon it, dragging the bottom of the ocean as we went. At first it was a little awkward to fish in such deep water, but our men got used to it and soon could cast a grapnel almost as straight as an old whaler throws a harpoon. Our fishing-line was of formidable size. It was made of rope twisted with wires of steel so as to bear a strain of thirty tons. It took about two hours for the grapnel to reach the bottom, and we could tell when it struck. I often went to the bow and sat on the rope and could feel by the quiver that the grapnel was dragging on the bottom two miles under us. But it was a very slow business. We had storms and calms and fogs and squalls. Still we worked on day after day. Once, on the 17th of August, we got the cable up, and had it in full sight for five minutes, a long slimy monster fresh from the ooze of the ocean's bed; but our men began to cheer so wildly that it seemed to be frightened, and suddenly broke away and went down into the sea. This accident kept us at work two weeks longer;

but finally on the last night of August we caught it. We had cast the grapnel thirty times. It was a little before midnight on Friday night that we hooked the cable, and it was a little after midnight Sunday morning when we got it on board.

"What was the anxiety of those twenty-six hours! The strain on every man's life was like the strain on the cable itself. When finally it appeared it was midnight; the lights of the ship and in the boats around our bows as they flashed in the faces of the men showed them eagerly watching for the cable to appear on the water. At length it was brought to the surface. All who were allowed to approach crowded forward to see it; yet not a word was spoken; only the voices of the officers in command were heard giving orders. All felt as if life and death hung on the issue. It was only when it was brought over the bow and on to the deck that men dared to breathe. Even then they hardly believed their eyes. Some crept toward it, to feel of it to be sure it was there. Then we carried it along to the electricians' room to see if our long-sought treasure was living or dead. A few minutes of suspense and a flash told of the lightning current again set free. Then did the feeling long pent up burst forth. Some turned away their heads and wept. Others broke into cheers, and the cry ran from man to man and was heard down in the engine-rooms deck below deck, and from the boats on the water, and the other ships, while rockets lighted up the darkness of the sea. Then with thankful hearts we turned our faces again to the west. But soon the wind rose and for thirty-six hours we were exposed to all the dangers of a storm on the Atlantic. Yet in the very height and fury of the gale as I sat in the electricians' room a flash of light came up from the deep which, having crossed to Ireland, came back to me in mid-ocean telling that those so dear to me whom I had left on the banks of the Hudson were well and following us with their wishes and their prayers. This was like a whisper of God from the sea bidding me keep heart and hope. The 'Great Eastern' bore herself proudly through

the storm as if she knew that the vital cord which was to join two hemispheres hung at her stern; and so on Saturday, September 7th, we brought our second cable safely to the shore.

"Such, gentlemen, in brief is the story of the telegraph which you have wished to hear. It has been a long, hard struggle — nearly thirteen years of anxious watching and ceaseless toil. Often my heart has been ready to sink. Many times when wandering in the forests of Newfoundland in the pelting rain, or on the decks of ships on dark stormy nights — alone, far from home — I have almost accused myself of madness and folly to sacrifice the peace of my family and all the hopes of my life for what might prove after all but a dream. I have seen my companions one and another falling by my side and feared that I too might not live to see the end. And yet one hope has led me on, and I have prayed that I might not taste of death till this work was accomplished. That prayer is answered; and, now, beyond all acknowledgments to men is the feeling of gratitude to Almighty God."

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## THE RÖNTGEN RAYS, AND THE WONDERS THEY PERFORM.

BY

F. M. Holmes.

EARLY in the year 1896 the civilized world was startled by a discovery which sounded like a tale of fairyland. Certain rays were found which would pass through parts of the human body, and cast a shadow-picture of the bones and joints on a photographic plate.

The statement seems incredible; but further thought suggests that if ordinary light will pass through a solid

[1] From "Surgeons and their Wonderful Discoveries."

plate of glass, why should not rays exist which would pass through other substances?

That is ridiculous, you reply, because glass is transparent; but why, it may be answered, should not other materials be transparent, or partly so, to other forms of light?

In any case certain rays were discovered, which, whether a form of light or not, had the power of passing through the human body and also through some other materials, and of photographing substances within them on a sensitive plate.

The rays soon became fairly well known by the name of their discoverer, Professor Röntgen of Würzburg University, Bavaria, though he called them at first the X-rays — from our old friend, X, the algebraical sign for an unknown quantity — and they have been found of immense service in surgery.

Now, though the name of one man is connected, and rightly connected, with this discovery, yet, like many other discoveries, several men have contributed to it. Thus, the celebrated English chemist, Professor Sir William Crookes, showed, twenty years previously, that if an electric current be passed from an induction coil through a tube or bulb of glass, from which the air has been exhausted by an air pump, certain 'rays' were emitted from the negative, or cathode, electrode of the tube connected with the negative pole of the coil. Further, should these rays fall on certain substances, or even on the glass of the tube, light was excited capable of acting on a photographic plate.

Many years previously, Beccaria noticed that, should a vacuum tube be broken in the dark, a faint phosphorescent light was produced. There have been other workers in the same field, such as Hittorf and Abney. Heinrich Hiez, a celebrated German electrician, discovered that the rays passed through aluminium foil, and Lenard, his pupil, a Hungarian, put a small piece of aluminium in the Crookes' tube and took photographs with the rays in the dark. His results, however, were

buried in a long treatise and did not attract much attention.

Now Röntgen went beyond these discoveries and showed that these — or similar — mysterious rays would pass through the human hand, or part of the body, and would cast a shadow picture on a photographic plate His experiments leading to this discovery were made toward the end of 1895, but were not published abroad until January, 1896. The discovery, no doubt, became so suddenly popular, because everybody could grasp the startling idea that their bones could be photographed, though they might not comprehend how it was done.

How, then, are these mysterious rays produced?

The essence of the method may be thus described. Take a Crookes' tube, that is, a suitable glass tube or bulb, having a wire from an electric apparatus fitted at either end, and the air in the tube being exhausted, or drawn out by an air pump, the electric circuit is, of course, broken by the vacuum in the tube between the ends of the wires. Now, should an electric current be sent along the wires, and a living hand be placed between the tube and a photographic plate, a shadow-picture is obtained revealing clearly the joints and the outlines of the bones. In this way Röntgen obtained shadow photographs of several concealed objects, such as weights in a box, and a needle and a compass card in a metal case. From his experiments he supposed that some invisible rays were generated by the electric disturbance, and that these rays were able to pass through various bodies placed in their path, some bodies, less permeable to the rays than others, casting a shadow. He could not determine the nature of the rays, and therefore used the algebraical sign and called them the X-rays. The public, however, soon affixed the discoverer's name instead of X, and, as it were, by common consent they were speedily and popularly called the Röntgen Rays.

Professor Röntgen was born at Lennep, Dusseldorf, in Prussia, in 1844, and was educated at Zurich, and was professor at Würzburg University, Bavaria, when he made his now world-famous discovery.

The mysterious rays were soon put to practical use. Professor Mosetig, of Vienna, tested them on two patients on January 21, 1896, with complete success. A man had received a revolver shot in the left hand, and the Röntgen-ray picture showed the injuries caused and the position of the shot with great clearness and precision. The second instance showed the position and nature of a malformation of a girl's left foot, and these early experiments indicated almost conclusively that the surgeon might find by the rays the exact spot where he might operate with comparative ease.

England, also, was not far behind. The *Lancet* for the third week in January, 1896, issued two reproductions from Röntgen-ray photographs, showing a human hand and also a frog. The journal described them as taken "by means of the radiation from a Crookes' phosphorescent tube, actuated by a so-called high frequency current (a current of high pressure and periodicity)." Powerful apparatus in Mr. A. C. Swinton's laboratory in London, England, was used, and both objects to be photographed were placed on a sheet of aluminium, resting on a sensitive plate in its ordinary dark slide. Aluminium allows these rays to pass through, but is impervious to ordinary light. The hand was exposed for four minutes and a half, and the frog nearly twenty minutes, and the negative was developed in the usual manner by Mr. G. Stanton.

The photographs showed clearly to every surgeon the importance of the discovery. The bones and the finger joints of the hand could be seen quite distinctly, while the bony part of Master Froggy appeared quite dark as compared with the lighter tone of the surrounding part.

Again, on the evening of January 28th, the same results of the process were shown at the rooms of the Royal Photographic Society, and on that occasion Mr. J. W. Gifford exhibited what is regarded as the first Röntgen-ray medical or surgical photograph taken in Britain — namely, the picture of a human foot clearly showing a malformation of the metatarsus, that is, of the middle bones of the foot.

About a couple of months later, the *Lancet* again published a couple of prints indicating the possibilities and value of the new photography. The prints not only showed clearly the spinal column, ribs and right elbow-joint of a small dead monkey, but also a uric acid renal calculus which had been inserted into the right-hand kidney. A gall-stone had been placed in the left-hand kidney, but this was not so clear.

News of the astounding discovery was not long in penetrating to all parts of the world, and from various quarters came reports of repetitions of the experiments. Yet actual applications to surgery were for a time few in number.

Perhaps the first in the Western Hemisphere was made at M'Gill University, Montreal. Before any detailed descriptions had reached him, Professor Cox was able at a first attempt to gain an excellent photograph of the human hand, and a day or two later — that would be early in 1896 — the rays were used to determine the position of a bullet in a patient's leg.

A bullet had been lodged about the middle of the calf since the night of the previous 25th of December. Forty minutes' exposure was given, and a photograph was produced showing clearly the bones within the gauzy shadow of the flesh, and between the two bones — that is, between the tibia and the fibula — the flattened bullet could be seen against the inner angle of the tibia. Acting on this information, the surgeon extracted the bullet the next day with an incision two inches deep.

Mr. A. A. Campbell Swinton was one of the first in England to experiment with the rays; and in a lecture before the Royal Photographic Society, on February 11, 1896, he gave a brief account of the state of knowledge then existing regarding them. Ordinary vacuum or Geissler tubes were of little use, the phenomena not occurring except in the much higher vacua of Crookes' tubes. The difference, he explained, was that in the former tubes luminescence was due to gases left in the tubes, but in the Crookes' tubes it was due to the cathode

rays from the negative electrode, and on striking the end of the tube, or a plate of metal inserted in it, the phenomenon was caused. It was important to use tubes of the right description.

The rays proceeded from the bright spot on the glass where it was struck by the cathode rays, and if the spot were large the photographic plate might be held farther from the tube than if the bright patch were small. As to length of the exposure, he had obtained a fairly good picture of part of the body in fifty-five seconds.

The first photograph taken for actual use in practical operative surgery seems to have been at Liverpool toward the end of February, 1896. It was taken by Professor Lodge, of University College, Liverpool, and showed a bullet in a boy's wrist.

Mr. Robert Jones, honorary surgeon to the Royal Southern Hospital, Liverpool, reports the case in the *Lancet,* February 22, 1896. "A boy, aged about twelve years," he says, "was brought to me by Dr. Simpson, of Waterloo, Liverpool, having shot himself in the left hand just above the deep palmar arch. The wound was enlarged but the bullet could not be found, and it was thought injudicious to prolong the search, in view of the important structures in the vicinity, unless one possessed a clue to its position. Professor Lodge (of University College, Liverpool) kindly consented to take a photograph, and the position of the bullet, which was found in the wrist, was very clearly outlined. . . . This is, I think, the first photograph taken of a bullet embedded in a wrist, in this case considerably thickened as the result of inflammation."

In this case Professor Oliver Lodge took the photograph after two hours' exposure to a well-exhausted vacuum tube — home made — excited by an ordinary and small coil. The photographic plate was an Edwards' iso-chromatic. It was placed nine inches apart from the vacuum tube, and sheet aluminium was used to screen it from light.

The rays began to be used with great success in sur-

gical practice, and the following case occurred in the practice of Mr. Howard Marsh, and was referred to by Lord Lister in his British Association address at Liverpool in 1896.

Mr. Marsh was called to treat a severe injury of the elbow, and the swelling was so great that he could not tell whether the trouble was due to a dislocation or to a fracture. If the former, a cure would have to be effected by violence, which would, on the other hand, be most injurious if a bone were broken.

What was to be done?

The Röntgen Rays were used, and by their help a photograph was taken, the picture showing the injury to be a dislocation; the bone of the upper arm was seen to be displaced forward on the bones of the forearm. Mr. Marsh therefore proceeded to reduce the dislocation, that is, to place the bones in their right position, and another photograph, taken afterward, showed them to be correctly replaced.

In this case, it is evident, the use of the rays was of very great assistance.

The difference in the power of penetrating different substances shown by the Röntgen Rays is very peculiar. Thus black paper is pervious to them; but lead glass is less transparent than soda glass. They strike through wood, but find bone opaque. Black paper, it may be remarked, would shield a photographic plate against the light from an arc lamp.

Mysterious as they are, the rays can be popularly understood in this respect, that they possess the power of passing through some substances which are opaque to ordinary rays of light. But their behavior is very strange and perplexing, for they may pass through a case of wood or leather, in which they may be enclosed, while a pair of spectacles may stop them.

It is more comprehensible to find, as we have seen, that, generally speaking, the denser the object, the greater is the obstacle opposed to them. Thus the bones of the human body being denser than flesh, they cast a

denser shadow; while metals like iron, lead, and copper, being denser than bones, also cast heavy shadows, and thus the rays reveal a bullet embedded even in a bone, or a needle in a joint.

Advantage is therefore taken of the fact that the rays produce apparently the same effects as ordinary light upon a photographic plate. If, therefore, the hand or arm be placed above the photographic film, which is suitably encased and at the requisite distance from the source of the rays, they are almost stopped by the bones, but much less so by the flesh, and a picture is gained in which the bones appear in sharp relief in the flesh and anything unusual is clearly exhibited. A picture is thus obtained of the interior of the body, and the aid given to the surgeon is obvious.

The rays have also the property of causing certain substances to fluoresce — that is, to become self-luminous when exposed to the direct action of rays of light — and if the Röntgen rays are directed to a translucent screen impregnated with a salt that will so fluoresce, it becomes beautifully illuminated. If the part of the human body to be examined be placed between the screen and the rays, the bones and other parts will throw shadows upon the screen. Thus it was that Dr. Macintyre, of Glasgow, detected a coin in a boy's gullet without the delay of taking a photograph. Mr. Herbert Jackson, of King's College, early became distinguished for this branch of the Röntgen-ray practice. Thus the rays are used in two ways, viz., by taking a photograph, and by throwing a shadow on a screen.

A picture was also taken by Dr. Macintyre of the halfpenny in the boy's gullet, and it was shown at a conversazione of the Royal Society in 1896. The picture exhibited with perfect distinctness the coin, low down in the boy's gullet, the rays having penetrated the bony framework of the chest to obtain the picture. The halfpenny had been there for six months, causing, curiously enough, uneasiness at the pit of the stomach during swallowing. But the position of the coin remained abso-

lutely uncertain until these wonderful rays piercing the bones, threw light on the subject in more senses than one.

Having thus determined the position of the coin, the surgeon in charge of the case attempted to extract the piece of metal. He was not immediately successful, but he dislodged it. A subsequent photograph showed that it had disappeared from the gullet, but so great was the penetrating power of the rays, that they showed also it had not lodged lower down in the alimentary canal. It is pleasant to record that the lad afterward completely recovered.

The heart being denser than some other parts of the human internal economy, throws a very satisfactory shadow on the fluorescent screen, and its movements in a living body may by this means be observed.

An excellent method of obtaining the rays was found to be by the employment of a cup-shaped cathode within the tube, the cathode so placed as to radiate on a plate of platinum placed obliquely, whence the radiation struck the wall of the tube. It was believed that the structure of the glass became gradually altered, and the external radiation thereby affected. Platinocyanide of potassium or barium becomes strongly fluorescent — self-luminous — under the rays, and it was found a good plan to receive the ray from the tube on a screen coated with one or other of these substances.

The rays, however, require to be used with care. If the skin be too long exposed to their action they are apt to cause great irritation and to affect it with, in Lord Lister's words, "a sort of aggravated sun-burning. This suggests the idea," he adds, "that the transmission of the rays through the human body may be not altogether a matter of indifference to internal organs, but may, by long-continued action, produce, according to the condition of the part concerned, injurious irritation or salutary stimulation."

Investigation into the rays has, of course, proceeded in many quarters, and in 1897, a Röntgen Society was formed. Professor Silvanus Thompson, in his presi-

dential address, on November 5th in that year, declared that, excepting antiseptics and anæsthetics, no discovery of the nineteenth century had done so much for operative surgery. The rays had been applied to the diagnosis of fractures and dislocations, the study of bone diseases, and the detection of foreign substances in the human body. Even the progress of tubercular disease in the lungs had been seen, and the observation of the beating heart was now an everyday experience.

The invention of focus tubes furnished powerful sources of the rays, and then it was noticed that exposure to them frequently caused severe local inflammation; if on the head, it was accompanied in some instances with at least temporary destruction of the hair, which fell out and left patches of baldness.

The cause of this result does not seem clear — whether it was sunburn, whether it was electrical, or whether it was due to the chemical action of ozone which was generated from the oxygen of the air; but in any case the results of too long exposure are evidently most injurious and have even caused death.

Many speculations were put forward as to the physical character of the rays. Crookes and some others supposed them to be flights of very tiny atoms or hyper atoms; some regarded them as an extreme ultra-violet light; apparently Röntgen himself inclined to the opinion that they were due to longitudinal vibrations, and Sir George Stokes that they might be innumerable, transverse, solitary waves. Apparently they are not homogeneous, but of different kinds, varying in power of penetration and varying also from the state of the vacuum, the emitting surface, and also on the form of the tube. There appears, moreover, to be some difference between the true Röntgen rays and the cathode rays.

They have passed extensively into surgical practice, even a small hospital-ship steam trawler called the *Alpha,* intended for work among the fishing fleets of the North Sea, being fitted with the apparatus. On this boat, of course, the rays are very useful in immediately exam-

ining fractures and dislocations sustained by the men in their work.

The rays have been much used in the treatment of the wounded in war. They assist in the diagnosis of injuries from shot, as well as in searching for the damaging bullet; they also enable the surgeon to observe the repair and recovery of wounds, and the position of bones which have been shattered and afterward treated. Indeed, they may furnish much valuable information concerning the effects of treatment and the process of repair.

In the great Boer War, which commenced in October, 1899, the rays were used in South Africa, as well as in the hospitals in England; the track of the bullet could frequently be noted in the body by a deposit of the metal which was left.

An instance of this kind was reported in the *Physician and Surgeon* by Dr. A. Barry Blacker, Superintendent of the X-ray Department at St. Thomas's Hospital. It was the case of a soldier who was struck by a bullet in the left hand, at Colesberg, and was invalided home. He was taking aim with his rifle when the bullet struck off the thumb of his left hand. The course of the bullet could be seen by the rays, along the index finger, "leaving in its course a track of metal."

Another instance mentioned by Dr. Blacker was that of a soldier whose neck was pierced by a bullet at Colenso; the rays revealed the missile, which appeared to be a Mauser bullet, resting on the side of the fifth cervical vertebra. The soldier suffered pain and stiffness in the neck, but no further symptoms of injury to the nerves were manifested.

Dr. Blacker noted five points which had been remarkable in soldiers wounded by gunshots and invalided home, and examined by the Röntgen rays. He observed the rarity of the instances when projectiles or bullets had been retained; the great amount of bone shattering which had been caused, compared with the small holes made by the Mauser bullet in entering and in leaving the body; the excellence of bone repair; the comparative absence of

sinuses, that is, unnatural passages which discharge; and the frequent occasions when the track of the bullet could be noted by the deposit of metal.

The X-rays were found most useful in the base hospitals and on the lines of communication. Seventeen sets of the regulation apparatus had been sent to South Africa, by the autumn of 1900, and they were used in all the larger military hospitals.

The employment of the Röntgen rays in military surgery has been regarded as one of the greatest advances of the nineteenth century. Their use enables the old probing after bullets to be dispensed with, and reveals the injury to bones. Pain and possible infection are thus avoided. But as the surgeon in charge of the apparatus seldom operates on the patient, and as a dark-room is needed for the fluorescent screen, the rays have not been much used actually on the field. No doubt if it be possible to obviate these difficulties they will, however, be so used in future.

The physical nature of the rays still remains a mystery. Scientists cannot at present polarize, reflect, or refract them. But surgeons and medical men use them so freely, and with such increasing success, that next to the introduction of anæsthetics and of antiseptics they will probably rank as one of the greatest aids to surgery and to therapeutics discovered in the nineteenth century.

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## RADIUM AND RADIO-ACTIVITY.

THE marvels of radium may be said to have been more or less foreshadowed by the discovery of the Röntgen rays. It was immediately determined that the emanations of a Crookes tube were not ethereal undulations such as ordinary light, but that they consisted of actual material particles of matter highly

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charged with electricity. Naturally the attempt was made to discover whether the phenomena of phosphorescent substances were not akin to those of the Crookes tube. The leading spirit in this movement was Professor Henri Becquerel, who selected the metal uranium as the subject of his experiments. He accidentally discovered that the so-called phosphorescent attributes of uranium were not due to the absorption of sunlight, but that the substance was spontaneously active, and that the light which came from radium was a new kind of emanation entirely different from the X-rays. To these new radiations the name "Becquerel Rays" was given.

Uranium is obtained from pitch-blende, an ore more or less widely distributed through the world, but found chiefly in Bohemia and Cornwall. Madame Curie, who at the time Becquerel was making his investigations, was a senior student at the Municipal School of Physics and Technical Chemistry in Paris, had selected "Radio-Activity"—a name which she coined—as the subject of her Doctor's thesis. Naturally it was necessary for her to study uranium and similar minerals with some care. She found that, after having extracted all the uranium contained in her specimen of pitch-blende, there still remained in the residue a substance far more active than uranium. After isolating this unknown radiant substance and analyzing it, she found that it contained two new elements. The one she christened "polonium," after Poland, the land of her birth; the other she named "radium."

Several tons of pitch-blende must be treated and concentrated before a few grains of radium are obtained. But those few grains are worth more than any precious gem or metal in the world. Indeed they have almost any value which their fortunate possessor may choose to give them. There are probably not two pounds of pure radium in existence; but at the present market price they would be worth each at the very least several million dollars. There is more gold in sea water than radium in pitch-blende; and that is why its price is so high.

The properties of radium will probably necessitate a decided revision in some time-honored chemical theories; for radium refuses to conform to our long-established atomic theories, and behaves in a most inexplicable fashion. In the first place the radio-activity of the element has been found to consist of three distinct sets of emanations, which have been respectively christened the Alpha, the Beta, and the Gamma rays, for want of better names.

The Alpha rays are not, like ordinary light, ethereal pulsations, but actual material particles hurled off at a speed of about 20,000 miles per second from the parent mass. They are highly charged with positive electricity. Their speed is about 40,000 times greater than that of a rifle bullet.

The Beta rays, which consist of particles of matter, corpuscles of electricity or "electrons" as the modern physicist calls them, move still more swiftly. Each of the Beta particles (very much smaller in size than the Alpha particles) travels at the rate of about 100,000 miles a second. They are the fastest moving objects known in the universe; for their speed is three hundred times faster than that of the swiftest star. Such is their velocity that it takes a foot of solid iron to stop them.

The Gamma rays are probably Röntgen rays, if one may judge by the similarity of the properties of the two. Like the Beta rays, the Gamma emanations have remarkable penetrating properties. But of the three kinds of rays discharged by radium, the Gamma rays are the most difficult to detect and the least perfectly understood.

Professor Curie, Madame Curie's husband, has discovered that radium constantly maintains a temperature of about five or six degrees above the surrounding atmosphere. For some time this startling phenomenon baffled physicists. Here was a substance constantly giving off heat without being apparently consumed, and without anything to make it hot. It is now thought that this strange property can be explained by assuming that the particles collide with one another, and that the heat

generated by the impact (a heat that must be very marked when it is considered how enormous is the energy of a particle moving at the rate of many thousand miles a second) is sufficient to explain the heat generated by radium.

The fact that radium is a spontaneous source of thermal energy is in itself a fact sufficiently startling. Sir William Ramsay, however, has discovered still other startling properties of this startling substance. He collected the material particles which are shot from the substance, analyzed them, and found that after a few days they changed into helium, a gas which was first discovered burning in the sun. This seems dangerously like the transmutation of one element into another, the problem on the solution of which the medieval alchemist had worked for centuries. After ages of labor seventy-odd bits of primordial matter had been wrung from the earth, so simple and so unchangeable in their nature that they were deemed elements. And now one of them proves to be nothing but the product of another. Can we ever be certain again that the rest are not also likely to change? Is it any wonder that our chemistry needs revision?

The atomic weight of radium has been ascertained by Madame Curie to be 225; that of helium is 2.2. In other words, every atom of radium breaks up into about 100 parts of helium. What becomes of the old teaching that atoms are indivisible particles of matter? Some of the more advanced thinkers have abandoned the atom and adopted the "electron" as the ultimate unit. The atom is certainly quite inadequate to account for the properties of radium. Atoms may be said to be composed of electrons moving, like miniature solar systems, with inconceivable rapidity in well-defined orbits. Sometimes a little planet of that system becomes unstable, darts off with terrific speed like a comet, and thus gives rise to the phenomena of radium, of uranium, and of every other radioactive substance.

Has radium any practical value? it may be asked. So far it is more of a scientific curiosity than anything else.

Still, it is not without some use. It is an excellent detector of false diamonds; for it causes the real gem to glow with wonderful brilliancy, while the paste imitation is left comparatively lustreless. Then, again, radium kills bacteria and even very small animals. The modern physician has used the substance with some success in treating certain diseases, among them cancer and lupus. Living tissues of the body are strangely affected by short exposures to the substance. Sores are produced, like burns, which heal only after weeks have elapsed. An electroscope has also been invented, the underlying principle of which is dependent upon the properties of radium.

# SELF CULTURE QUESTIONS

FRANK HEYWOOD HODDER,

Professor of American History, University of Kansas.

1. What is the underlying human instinct common to the three great subjects to which this volume is devoted? (pp. 17-20.)
2. In which of the centuries from the first to the 19th was there most activity in exploration and discovery? (pp. 22-24.)
3. What reasons have we for supposing that New England was explored by the Norsemen 500 years before Columbus? (pp. 25-31.)
4. To what portion of America was the name of New Spain first given? (p. 35.)
5. What was the real object of the Spaniards who came to America? (pp. 36 et seq.)
6. How was Cortez able to hold communication with the natives? (pp. 41-42.)
7. What do you think of the diplomacy of Montezuma in dealing with Cortez? (p. 44.)
8. What city was called "The Venice of the Aztecs?" (p. 49.)
9. When was the mariner's compass invented and by whom? (p. 51.)
10. Name some of the occupations of Christopher Columbus? (pp. 53-55.)
11. What were the obstacles put in the way of his carrying out his "Great Idea?" (pp. 56-57.)
12. What was the real object of the first voyage of Columbus? (p. 57.)
13. What is the origin of the name of "The West Indies?" (p. 64.)
14. What were the character, the pursuits, and religious beliefs of the natives of Cuba? (pp. 65, 66, 69, 70, and 72.)
15. How was Columbus received on his second visit to Cuba? (p. 74.)
16. How did America get its name? (p. 76.)
17. What name did the Indians give to the Rocky Mountains? (p. 81.)
18. Where is the Toltec Gorge? (pp. 82-84.)
19. Name some of Audubon's claims to distinction. (p. 88.)
20. Give some account of his exploring trips. (pp. 88-100.)
21. What was the effect upon Audubon of all his adventures and experiences? (pp. 99-100.)
22. How was gold first found in California and by whom? (p. 103.)
23. What are "placers" and what is placer mining? (p. 105.)
24. By what routes were the Californian gold fields reached? (pp. 106-107.)
25. What part does mercury play in gold mining? (p. 111.)
26. How does Bret Harte describe the early miners? (pp. 112-113.)
27. Describe the situation of the "Eldorado of the North." (p. 115.)
28. What is the difference between the gold first found in California and Alaska? (p. 116.)
29. Who first discovered gold in the Klondike? When and how? (p. 116.)
30. Describe the method of getting out the gold in Alaska. (pp. 117-118.)
31. How did the early gold seekers in Alaska reach the gold fields? (pp. 119-120.)
32. Where are the Andes? (pp. 127-128.)
33. What is the main difference between the mountain chains of the Old World and the New? (p. 128.)
34. Name the principal places called at by Bougainville. (pp. 137-158.)
35. What was the state of the Philippines when Bougainville visited there? (p. 143.)
36. Relate the anecdote of the envoy and the Governor of Java. (p. 147.)
37. Name some peculiarities of Surabayan etiquette. (pp. 156-157.)
38. What was the coincidence related on Bougainville's reaching Valparaiso? (pp. 156-157.)
39. What was the discovery made by Captain Speke in Central Africa? (p. 165.)
40. What were Livingstone's reasons for going to Africa? (p. 167.)
41. Why did Henry M. Stanley visit Central Africa? Who sent him there? (p. 168.)
42. What were some of the difficulties Livingstone met with (a) from the natives, (b) from the climate? (pp. 171-172.)
43. Why was it necessary for Vamberj to disguise himself in order to visit Khiva? (p. 173.)
44. How did his disguise succeed with the Khan? (p. 180.)
45. What is one mark of good breeding in Central Asia? (p. 181.)
46. What are the chief characteristics of the land of Tibet? (p. 186.)
47. How were Sven Hedin's plans frustrated? (pp. 188-201.)

48. How does Commander Lynch describe the appearance of Jerusalem? (p. 205.)
49. Name some of the most and some of the least credible relics and places shown in Jerusalem. (Read the whole of In and About Jerusalem.)
50. What was the most remarkable object seen on the shores of the Dead Sea? (pp. 218-219.)
51. Name some other peculiarities of the Dead Sea and its shores. (pp. 218-223.)
52. For what purpose were the Rock Temples of Ceylon said to have been originally built? (p. 224.)
53. Describe briefly the rock fortress of Sigiri. (p. 227.)
54. Why do not the Burmese grease the axles of their carts? (p. 230.)
55. How is rice harvested in Burmah? (p. 231.)
56. What do you know of the teak-wood industry in Burmah? (p. 235.)
57. What part do elephants take in it? Give a brief description of them at work. (pp. 238-242.)
58. What do you know of the coral reefs of the South Seas? (pp. 243-250.)
59. What are the most remarkable features of a Fijian landscape? (pp. 250-252.)
60. Did Captain Kane succeed in his two expeditions? (p. 252.)
61. Describe a remarkable effect of intense cold in the darkness. (p. 258.)
62. Give briefly an account of the several expeditions of C. F. Hall. (p. 259.)
63. Name some of the plants and flowers that grow in Frobisher's Bay. (p. 263.)
64. Several places about Frobisher's Bay are called after distinguished Americans. Name them. (pp. 266-268.)
65. What discovery most closely connects the Sixteenth with the Twentieth Century? (p. 271.)
66. Which century produced the greatest number of inventions? (pp. 271-277.)
67. Give a list of the inventions relating to Electricity, the Steam Engine, the Printing Press, and Photography from 1560 to 1906. (pp. 271-277.)
68. Which 12 of the distinguished American inventors do you think have most benefited mankind? (pp. 277-278.)
69. Give the names of a dozen of the most prolific inventors. (p. 279.)
70. What is the chief characteristic of women's inventions as compared with those of men? (p. 279.)
71. Who was the first colored patentee? (p. 280.)
72. Among the first steamboats, etc., which nation figures the most prominently? (p. 280.)
73. Describe some of the earlier methods of agriculture. (pp. 281-282.)
74. Who was the pioneer maker of agricultural machinery? (pp. 282-283.)
75. Name some record performances of agricultural machinery. (pp. 285-290.)
76. What kinds of power are employed to drive agricultural machinery? (pp. 285-290.)
77. What difficulties had the pioneers of transcontinental railroads to overcome? (pp. 290-304.)
78. When was the first across the continent railroad finished? (p. 295.)
79. What were the original motives for making across the continent railroads both here and in Canada? (p. 295.)
80. Describe the course taken by the Canadian Pacific R. R. (p. 298.)
81. What was the record in the way of railroad construction? (p. 300.)
82. What did Stephenson say to the designer of the Niagara Suspension Bridge? (p. 307.)
83. Give some figures about the construction of the Brooklyn Bridge. (p. 308.)
84. Why is it that American bridge builders are able to beat the world? (pp. 309-315.)
85. What was the great work of J. B. Eads? (p. 314.)
86. Name the chief pioneer balloonists. (pp. 315-322.)
87. How were the pioneer balloons made to ascend? (pp. 315-322.)
88. Name some of the earliest calculating machines. (pp. 322-323.)
89. What is the most famous calculating machine ever made? (p. 323.)
90. What is the most familiar calculating machine and what does it perform? (pp. 327-333.)
91. Give a general idea of what we mean by the ether. (pp. 334-338.)
92. Name some of the properties of magnets. (p. 338.)
93. What is the effect of a current of electricity on a magnet? (p. 340.)
94. How can you convert a poker into a magnet? (p. 341.)
95. What do you know of the relation of magnetism to electricity? (pp. 343-346.)
96. What practical results come from this relationship? (pp. 343-346.)
97. What part did (a) American and (b) British enterprises take in laying the first Atlantic Cable? (pp. 346-356.)
98. What do you know of the Röntgen Rays and their use in Surgery? (p. 356.)
99. What were the "Becquerel Rays?" (p. 368.)
100. Name some of the wonderful properties of Radium. (pp. 366-372.)

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